

VOLUME 3

Best Practices for the Assessment and Control of Chemical Hazards



*Best Practices Guidelines for Occupational Health
and Safety in the Healthcare Industry*

Government
of Alberta ■



CREDITS

This document has been developed by the Government of Alberta, with input from:

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- » Alberta Health Services
- » Alberta Continuing Care Safety Association
- » The Health Sciences Association of Alberta (HSAA)
- » United Nurses of Alberta
- » Alberta Union of Provincial Employees
- » Alberta Home Care and Support Association
- » Alberta Health and Wellness

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Section 1

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Overview
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Section 1: Overview

The healthcare industry includes complex, multi-faceted organizations as well as specialized facilities and service-providers. Chemical hazards may pose risks for workers over the full spectrum of occupations. In particular, chemical hazards can be found in laboratories, pharmacies, housekeeping, facilities maintenance, radiology, physical therapy, occupational therapy, food services, laundry, sterile processing, and often on patient care units. Community care workers, homecare workers, and people working in dental offices, physician offices, public health, and long term care facilities and residences can also be exposed to chemical hazards.

In this document, best practices for controlling exposure to chemical hazards in healthcare will be reviewed. This is not meant to be a definitive text on all chemical hazards present, but rather a summary of practices that have been shown to be successful for healthcare workers (HCWs) in reducing the health and safety risks related to working with chemicals.

A best practice is a program, process, strategy or activity that:

- » Has been shown to be effective.
- » Can be implemented, maintained, and evaluated.
- » Is based on current documented information.
- » Is of value to, or transferable to, other organizations.

Best practices are living documents and must be reviewed and modified on a regular basis to assess their validity, accuracy, and applicability. They may exceed, but cannot be less than, the requirements of the Occupational Health and Safety (OHS) Legislation.

In Alberta, the requirements for occupational health and safety are outlined in the *Occupational Health and Safety Act (OHS Act)*, *Regulation (OHS Regulation)*, and *Code (OHS Code)*. The *Act*, *Regulation*, and *Code* are available for viewing or downloading on the Alberta Employment and Immigration (AEI), Workplace Health and Safety (WHS) website at www.employment.alberta.ca. This document does not replace the *OHS Act*, *Regulation*, and *Code* and does not exempt anybody from their responsibilities under the legislation.

Resources

Official printed copies of the Alberta *OHS Act, Regulation, and Code* may be purchased from the Queen's Printer at www.qp.alberta.ca or:



Edmonton

Main Floor, Park Plaza
10611-98 Avenue
Edmonton, Alberta T5K 2P7

Phone: 780-427-4952

Fax: 780-452-0668

How this document is organized

In this document, chemical hazards and best practices for assessing and controlling them are considered from several perspectives. First, the sources of the hazards are considered. Next is a focus on specific hazards and mechanisms to control the hazards. Finally, a scan of the healthcare environment identifies major functional areas that may present chemical hazards.

How to use this document

This document is designed to be used as a resource to assist those responsible for the design and implementation of occupational health and safety programs with a specific focus on chemical hazards. Sections will also be useful for workers and management in developing hazard assessments and determining appropriate control measures. This volume draws from published literature (see Appendix 1) to provide information about practices that are widely considered to be effective in developing and improving OHS programs with respect to chemical hazards. It is intended to provide an occupational health and safety perspective on chemical hazards for HCWs.

Resources

Consider these Alberta OHS resources for obtaining more information:



- » Alberta Employment and Immigration www.employment.alberta.ca.
- » Alberta Continuing Care Safety Association.
- » Your organization's Occupational Health and Safety Committee.
- » Your organization's Occupational Health and Safety Department.
- » Your organization's Infection Prevention and Control Professionals.
- » Your organization's Public Health Department.
- » Your Union Occupational Health and Safety Representative.
- » Your department Occupational Health and Safety Representative.

Section 2

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Roles and Responsibilities
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SECTION 2: Roles and Responsibilities

The Alberta *Occupational Health and Safety Act, Regulation, and Code* combine to set out the legal requirements that employers and workers must meet to protect the health and safety of workers. The following requirements are presented in consideration of chemical hazards in the healthcare workplace. These are **minimum** requirements.

General Responsibilities

Employers must ensure, as far as reasonably practical/achievable, the health and safety of all workers at their work site.

EMPLOYERS MUST:

- » Assess a work site and identify existing or potential hazards.
- » Prepare a written and dated hazard assessment.
- » Review hazard assessments periodically and when changes occur to the task, equipment or work environment.
- » Take measures to eliminate or control identified hazards.
- » Involve workers in the hazard assessment and control process.
- » Make sure workers and contractors are informed of the hazards and the methods used to eliminate or control the hazards.

WORKERS MUST:

- » Take reasonable care to protect the health and safety of themselves and other workers.
- » Cooperate with their employer to protect the health and safety of themselves and other workers.

OHS Act, Section 2, OHS Code, Part 2 & Part 4

Worker Exposure to Harmful Substances

In Alberta, there are legal requirements to protect workers from exposure to harmful substances in the workplace.

Definition – Harmful Substance

Means a substance that, because of its properties, application, or presence, creates or could create a danger including a chemical or biological hazard, to the health and safety of a worker exposed to it.

OHS Code, Part 1 Definitions and General Application

Exposure to harmful substance

EMPLOYER MUST:

- » ensure that a worker's exposure to any substance listed in Schedule 1, Table 2 is kept as low as reasonably practicable/ achievable, and does not exceed its occupational exposure limit.

If no occupational exposure limit is established for a harmful substance present at a work site,

EMPLOYER MUST:

- » ensure that a worker's exposure to that substance is kept as low as reasonably practicable/ achievable.

OHS Act, Section 2; OHS Code, Part 4

Responsibilities – Harmful Substance

If a worker may be exposed to a harmful substance at a work site,

EMPLOYERS MUST:

- » Establish written procedures that minimize the worker's exposure to the harmful substance.
- » Ensure that a worker who may be exposed to the harmful substance is trained in the procedures, applies the training and is informed of the health hazards associated with exposure to the harmful substance.

WORKERS MUST:

- » Participate in the training provided by an employer
- » Apply the training

OHS Regulation Section 15

OCCUPATIONAL EXPOSURE LIMITS

In some cases, there is sufficient scientific information available to identify what level of exposure to specific chemicals may lead to adverse health effects. Information from accidental exposures, animal studies, or other assessments is used by regulatory agencies to determine occupational exposure limits (OELs) for specific chemicals and substances, over which workers are not to be exposed.

Definition – Occupational Exposure Limit

Means the occupational exposure limit (OEL) established in Schedule 1, Table 2 for that substance.

OHS Code, Part 1 Definitions and General Application

An OEL is the airborne concentration of substance for which it is believed that nearly all workers may be repeatedly exposed on a day-to-day basis without suffering health effects. The OEL refers to the airborne concentration of the substance to which the worker is exposed, not the concentration of the substance in the workplace.

www.employment.alberta.ca

Legislated Requirements

Legislated Requirements

The OELs do not provide a sharp demarcation of a safe versus unsafe exposure level for all workers. OELs are determined using the "healthy worker" model. Therefore, sensitized workers, workers who have certain medical conditions, or workers who are on certain medications may experience adverse health effects at exposure levels that are lower than the OEL.

Best Practice and Occupational Exposure Limits (OELs)



Focus

As a best practice, it is considered prudent to consider one-half the OEL as the "action level", where employers should implement controls to reduce exposure. When it is possible for workers' exposures to reach the OEL, employers should regularly monitor the work environment to ensure that the hazards are controlled.

Another important consideration when applying OELs is that many OELs are based on 8-hour exposure times, which allows sufficient time between work shifts for the substances to be cleared from the body. If work shifts are extended, clearance of the substance from the body may not be complete and metabolic by-products of chemicals may accumulate in the body resulting in adverse health effects. To address these issues, OELs based on 8-hour exposure times must be adjusted for any work shifts that exceed 8 hours. This adjustment is not required for some OELs that are based on the prevention of irritation effects which are designated by a "3" in the substance interaction column of Table 2 of Schedule 1 of the OHS Code. If a worker's exposure time is less than 8 hours, it is NOT permissible to increase the OELs.

For some substances, additional OELs are assigned based on short term exposures. These short term exposure limits (sometimes called STELs – Short Term Exposure Limits) are levels above which a worker should not be exposed for more than 15 minutes at a time, no more than four times a day. There must be a 60 minute period between exposures at the STEL, and the 8-hour OEL must still be respected. Some substances also have designated ceiling levels, which should never be exceeded. These substances are indicated with a "c" in Table 2 of Schedule 1. The ceiling level can be measured with direct reading instruments or other instruments which can effectively average measurements over one-minute periods.

Where no STEL or ceiling level exists, a worker must not be exposed to three times the 8-hour OEL for more than 30 minutes during any work day or five times the OEL at any time.

In certain situations, biological exposure indices (BEIs) are used for ongoing monitoring of worker exposures. BEIs have been developed by the American Conference of Governmental Industrial Hygienists (ACGIH) and measure exposure after it has already occurred. BEIs are available for some substances where measurements of metabolic products of chemicals can be performed on worker biological samples (such as blood or urine).

Alberta's OELs can be found in Schedule 1, Table 2 of the Occupational Health and Safety Code, found at www.employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_2009.pdf.



More information about OELs can be found at in the Alberta Occupational Health and Safety Code Explanation Guide for Part 4 (Chemical Hazards, Biological Hazards and Harmful Substances) found at www.employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_po4.pdf.

Resources

Information about shift work and OELs: www.employment.alberta.ca/documents/WHS/WHS-PUB_cho55.pdf.

Not all harmful substances have an OEL identified. In some cases, there is insufficient exposure data to determine a safe level of exposure. Prudent practice when working with harmful substances is to reduce worker exposure by protecting the route of entry for the substance.



Did you know?

WHMIS

The Workplace Hazardous Materials Information System (WHMIS) is a communication framework designed to ensure that workers are aware of the hazards of the substances (controlled products) that they work with and the precautions that must be taken to work with these substances safely. Many products used in healthcare do not fall under WHMIS legislation, but may be regulated under other legislation (e.g. Transport of Dangerous Goods Act, Explosives Act, Food and Drug Act, Pest Control Products Act, Nuclear Safety and Control Act). No matter which legislation governs the use of products, the employer is responsible for communicating the hazards and controls associated with the products to the workers who may use them.

Workplace Hazardous Materials Information System (WHMIS)

EMPLOYERS MUST ENSURE THAT:

- » Workers who work with or near controlled products are properly trained.
- » Supplier or work site labels are present on containers of controlled products.
- » Current and correct Material Safety Data Sheets (MSDS) are readily available for all controlled products.
- » Procedures and training are developed in consultation with the Joint Occupational Health and Safety Committee if there is one.

OHS Code, Part 29, Workplace Hazardous Materials
Information System (WHMIS)

Legislated Requirements

Controlled products are classified into 6 hazard classes. These are listed below with their corresponding hazard symbol.¹

WHMIS HAZARD CLASSES

A	COMPRESSED GAS	
B	FLAMMABLE AND COMBUSTIBLE MATERIAL	
C	OXIDIZING MATERIAL	
D	POISONOUS AND INFECTIOUS MATERIAL	
	1. MATERIALS CAUSING IMMEDIATE AND SERIOUS TOXIC EFFECTS	
	2. MATERIALS CAUSING OTHER TOXIC EFFECTS	
	3. BIOHAZARDOUS INFECTIOUS MATERIAL	
E	CORROSIVE MATERIAL	
F	DANGEROUSLY REACTIVE MATERIAL	

WHMIS has three elements:

1. **Labels** — WHMIS labels provide the information that a worker needs to know to handle a particular product safely.
2. **Material Safety Data Sheets (MSDSs)** — MSDSs provide basic technical information about a product's physical characteristics and its hazardous properties.
3. **Worker education** — Worker education provides workers with two kinds of information:
 - A general overview of WHMIS.
 - Specific hazard information and safe work procedures for products that they use at the work site.

¹ Information for this section has been derived from the Alberta Government, Workplace Health and Safety Bulletin "WHMIS – Information for Employers", revised July 2009.

Not all products used in healthcare are WHMIS-controlled substances. Some products are regulated by other legislation such as the Transportation of Dangerous Goods Act, Explosives Act, Food and Drugs Act, Pest Control Products Act, and the Nuclear Safety and Control Act. Although these other sources of legislation may not require that MSDSs be provided for the products, employers must develop work practices to protect workers and workers must be educated on the safe use of those products.



More information about other sources of legislation that regulate these substances can be accessed at:

Did you know?

Transportation of Dangerous Goods Act

www.tc.gc.ca/acts-regulations/acts/1992c34/menu.htm.

Explosives Act

www.laws.justice.gc.ca/en/E-17/index.html.

Food and Drugs Act

www.laws.justice.gc.ca/en/ShowTdm/cs/f-27///en.

Pest Control Products Act

www.laws.justice.gc.ca/en/P-9.01/.

Nuclear Safety and Control Act

www.laws.justice.gc.ca/PDF/Statute/N/N-28.3.pdf.

More information about WHMIS requirements can be found in the WHMIS – Information for Employers and WHMIS – Information for Workers bulletins available at www.employment.alberta.ca



Resources

And at WorkSafeBC's WHMIS Core Material: A resource manual for the application and implementation of WHMIS available at www.worksafebc.com/publications/health_and_safety/whmis/assets/pdf/whmis_core_full.pdf.

Section 3

Best Practice Features of an Injury
and Illness Prevention Program





Section 3 - Best Practice Features of an Injury and Illness Prevention Program

In the first volume of this series "Overview of Occupational Health and Safety in the Healthcare Industry", we looked at program elements that are common to all injury prevention programs. In this section, the program elements are aimed at controlling exposure to chemical hazards in the healthcare industry. The focus of the remaining sections of this volume is to provide in-depth information for identification, assessment and control of chemical hazards in the healthcare industry.

Management Commitment and Leadership

Senior management must clearly indicate that exposure to any chemical substance must be avoided and that management is committed to identifying and controlling chemical hazards in the workplace.

Hazard Identification and Assessment

The hazard assessment process must include the identification of potential hazards for jobs and tasks at each work site. Each hazard is then assessed for the level of risk that it presents. The frontline workers play a pivotal role in evaluating risk and determining appropriate precautions.

Hazard Controls

The hazard controls must incorporate the accepted hierarchy of effective controls. The most effective control is elimination of the hazard, but this is not always possible. The next control strategy is the use of engineering controls. Engineering controls reduce the possibility of exposure by controlling the hazard at its source. Examples of engineering controls for chemical substances include:

- » Substitution with a less harmful product.
- » Process modification.
- » Local exhaust ventilation.
- » Enclosures.
- » Automated processes.
- » Isolation rooms.
- » Safety-engineered devices and equipment.

The next level of control is administrative. Administrative controls are directed towards the workers, rather than directly at the hazard. Examples include:

- » Policies.
- » Safe work procedures.
- » Health assessments appropriate to the hazard.
- » Exposure monitoring appropriate to the hazard.
- » Training.
- » Scheduling.
- » Accommodation for workers with health issues.

Did you know?

Procedures and training must be developed and implemented in consultation with the Joint Occupational Health and Safety Committee if there is one.



Where engineering and/or administrative controls are not sufficient in controlling the hazard, the third choice is the use of personal protective equipment (PPE). PPE is considered the third choice as a control as it relies on proper PPE use, fit and worker training. If PPE fails, there is a high likelihood of worker exposure. Often several controls are applied simultaneously to effectively control a hazard.

Best Practices – Hazard assessment and control and harmful substances



The Alberta *Occupational Health and Safety Act, Regulations and Code (OHS Act, Section 2 & OHS Code, Part 4 & 35, 2009)* and best practices as set out in this document combine to guide the healthcare industry to ensure that worker exposure to harmful substances is kept as low as reasonably practicable / reasonably achievable through hazard assessment and control.

Towards an understanding of the terms “Reasonably Practicable / Reasonably Achievable”

Reasonably Practicable is a concept used by the courts to assess the “reasonable person test”. This test considers what a dozen peers (e.g. twelve nurses with equal qualifications and experience) would consider reasonable in a similar set of circumstances. The peers would likely review what happened and compare it against what they do in their own operations. Some of them might do more, others less. The result would be a balanced and wise judgment that could be defended to others.

It makes sense...

Reasonably Practicable is an OHS legal term that has been tested in the Canadian Courts and has supported a high standard for effective workplace protection. Understanding of the term reasonably achievable comes from the *Canadian Nuclear Safety Commission Regulatory Guide (2004)*, for “Keeping Radiation Exposures and Doses As Low as Reasonably Achievable (ALARA)”. Though the term reasonably achievable has not been given definite meaning by the Canadian Court system, it is generally accepted in industry and by regulators to encompass the same considerations as the concept of “reasonably practicable”.

Refer to www.employment.alberta.ca/documents/WHS/WHS-PUB_li015.pdf.

ADDITIONAL RESOURCES

A more complete guide to the Alberta OHS Code is available in the Alberta OHS Code Explanation Guide, which can be accessed at www.employment.alberta.ca.

Reporting Procedures

All incidents that result in chemical exposures or suspected exposures should be reported, investigated and clearly documented. Medical follow-up is sometimes necessary, particularly when acute or chronic effects may be experienced. Any exposure that results in modified work, medical treatment, or in a worker's absence from work must be reported to the Workers' Compensation Board. Workers should be encouraged to use standard reporting procedures to report exposure incidents and near misses. A good reporting program includes investigation and follow-up on all incidents and a process to "report back" to workers about the status of the situation.

Record Keeping

Records are important for the smooth running and continual improvement of health and safety programs. Records of incident investigations can be analyzed for trends and used to determine actions. Records of all exposure monitoring must be maintained and evaluated for required action. Records of hazard assessments and controls support due diligence requirements. Training and PPE fit-testing records are required by legislation and are important to ensure that all applicable workers are prepared to use the designated controls.

Communication and Collaboration

Good communication and a collaborative approach are important for an effective program. Alberta WHMIS legislation sets minimum standards for hazard communication involving WHMIS controlled products. Many products used in healthcare do not fall under WHMIS legislation, but may be regulated under other legislation. No matter which legislation governs the use of products, the employer is responsible for communicating the hazards and the controls associated with the products to the workers who may use them. In addition, for all "harmful substances", the OHS Code contains requirements to inform workers of health hazards from exposure, results of exposure monitoring done at the work site and procedures developed by the employer to minimize worker exposure.

Program Evaluation and Continuous Quality Improvement

All programs including OHS and exposure assessment plans need defined goals and objectives and a way to measure progress and outcomes. The program should provide a clear understanding of the scope and responsibilities for program evaluation. Regular monitoring of the program enables early detection of trends. Improvement opportunities can be identified, and the program can evolve to meet changing needs, best practices, and the organization's experience.

Focus

Routine Exposure Monitoring

The OHS Code requires that where a worker may be exposed to a harmful substance at a work site, employers must identify the health hazards associated with exposure and assess worker exposure. An occupational hygiene program can be established in all workplaces where workers may be exposed to hazardous chemical substances. The purpose of an occupational hygiene program is to ensure that all potential exposures are identified, assessed and regularly evaluated and documented. Exposure monitoring assists the organization in evaluating whether the organization is complying with OELs and also evaluates the effectiveness of controls and helps determine trends. It also provides the basis for recommendations of more effective controls. Alberta OHS legislation requires that exposure monitoring be conducted by a "competent" person. Comprehensive occupational hygiene programs are often designed and implemented by certified or registered occupational hygienists.

For more detailed information about the requirements for exposure monitoring, consult the Alberta OHS Code, Part 4, Sections 20 - 22 at: www.employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_2009.pdf



Section 4

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Identification of Chemical Hazards in the Workplace
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Section 4 - Identification of Chemical Hazards in the Workplace

A chemical hazard is a chemical that, because of its characteristics and effects, may cause harm to an individual. The level of harm that may occur is impacted by a variety of factors, including the amount of chemical, the time frame over which the exposure occurs, how the exposure occurs (route of entry), and characteristics of the individual.

Potential Worker Exposure

The Alberta OHS Code requires employers to identify health hazards and assess worker exposure levels and communicate the results of the assessments.

OHS Code Part 4, Sections 21 and 22

A chemical may be a liquid, a solid or a gas. Some chemicals may exist in more than one form (e.g. nitrogen as a gas at room temperature, but as a liquid under very low temperature and high pressure). The physical state of the chemical influences the route of entry of the chemical into the body.

Some useful definitions:

- » **Mist** – An airborne cloud of tiny liquid particles produced when a liquid chemical is sprayed, shaken or stirred, agitated or condensed from vapour. Example – Spray paint creates a mist.
- » **Vapour** – Produced when liquids evaporate from the application of heat or pressure or naturally at room temperature and pressure. Example – Solvents

Some important principles of toxicology

"All substances are poisons; there is none which is not a poison. The right dose differentiates a poison...." Paracelsus (1493-1541)

A general principle of toxicology is the concept that the toxicity of the chemical is related to how much of the chemical a person is exposed to. Other important factors in determining the toxicity of chemicals are²:

Legislated Requirements

Focus

Focus

² Guidelines for Laboratory Safety, Edition 6, 2006; Gene Marie Shematek, Wayne Wood; Canadian Society for Medical Laboratory Science. ISBN 0-921479-10-7

- » Chemical properties e.g. flammability, corrosivity, solubility.
- » Physical properties e.g. volatility, density.
- » Physical state e.g. solid, liquid, gas.
- » Toxicity e.g. carcinogenicity, neurotoxicity.
- » Amount of exposure.
- » Duration of exposure.
- » Route of entry e.g. inhalation, skin absorption, ingestion.
- » Metabolism of the chemical.
- » Target organs.
- » Interactions with other substances e.g. synergistic effects.
- » Manner in which substance is handled.
- » Susceptibility of individual(s) exposed e.g. pregnant worker.

Routes of entry

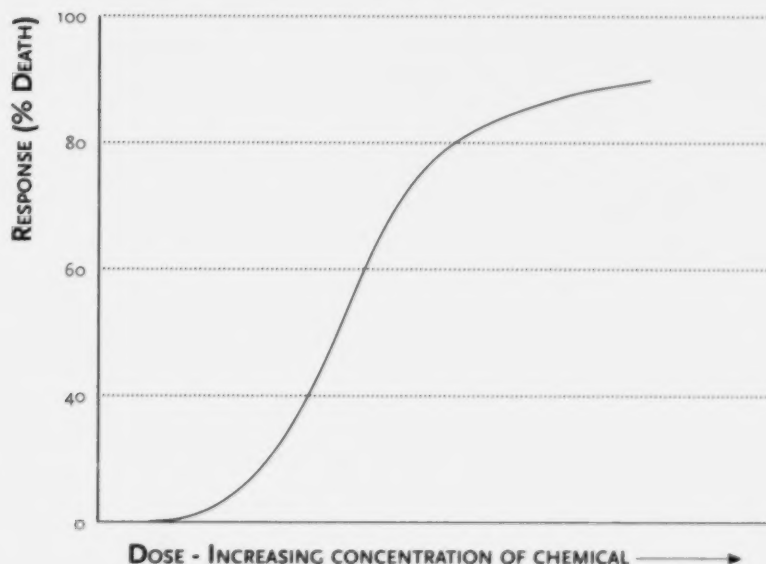
Most occupational exposures to chemicals occur by inhalation. Once a chemical reaches the lower levels of the lungs, it can pass into the bloodstream and travel to a target organ where it will exert its effects. Sometimes chemicals can be absorbed directly through the skin. Ingestion is rarely a route of exposure in the workplace, but may occur if housekeeping and personal hygiene practices are not adhered to. Injection is a route of entry for some chemicals, particularly drugs, where the use of needles is common in product handling, dispensing or delivery.

Chronic versus Acute Exposure

An acute exposure is an exposure to a substance over a brief period of time (usually 24 hours or less) that has an immediate or delayed impact on the person exposed. A chronic exposure is an exposure to a substance that occurs over a long period of time, which allows the toxicant to accumulate and cause toxic effects in the body. In some cases, toxic effects resulting from an acute exposure may target a different part of the body than those resulting from chronic exposures. An example of this is methyl methacrylate that causes skin irritation as an acute effect and sensitization as a chronic effect. In healthcare organizations, exposures to chemicals may be chronic, resulting from performing similar tasks with chemicals over the course of a worker's career.

The dose-response principle

The basic principle in toxicology is the relationship of the dose of chemical and its effect in the body. This is traditionally depicted in a dose-response curve. Shown below is a typical dose response curve. This curve usually indicates that at low levels of dose (or exposure), there may be no observable response. A common dose response figure that is found on many MSDSs is LD₅₀ (lethal dose 50). The LD₅₀ is the dose of a particular substance that results in the death of 50% of test animals in a controlled study.



Metabolism of chemicals

When considering occupational exposures to chemical substances, it is important to consider how the chemical moves through the body, where it is metabolized, intermediate chemical structures that may result from metabolic pathways, and how the chemical is excreted or stored by the body. Toxicokinetics is a term used to describe the movement of toxins through the body. This concept becomes important when considering occupational exposures that are repeated frequently and in situations where the toxins do not have sufficient time to be cleared from the body. In some cases, chemicals may become less toxic as they are metabolized. In others, metabolites may be more toxic than the original chemical, and in some cases, the chemicals are just stored in the body.

Target organs and sites of action of workplace chemicals

A useful way of classifying chemicals is by the portion of the body that is adversely affected once they are in the body. This is referred to as the site of action or target organ. In some cases, chemicals or their metabolic products may be stored in one organ and exert its toxic effect on another. Some of the major sites of action or target organs are:

- » Respiratory system.
- » Skin.
- » Cardiovascular system.
- » Kidneys.
- » Sensory organs.
- » Nervous system.
- » Liver.
- » Reproductive system.
- » Immune system.

Each of these systems may be impacted by acute or chronic exposures with various outcomes. Exposure to more than one chemical may produce additive, potentiating or synergistic effects.

A chemical that is an irritant causes an immediate reaction when the worker is exposed to the chemical. It may affect the part of the body in contact with the chemical (skin, respiratory tract, etc.) or produce a more systemic response due to absorption of the chemical.

Did you know?

A chemical that is a sensitizer does not usually result in an adverse reaction to the initial exposure, but with repeated exposures, the responses may be severe as a result of an allergic response that is triggered.

Latency Period

A latency period is defined as the time between exposure to a toxic substance and the development of symptoms of that exposure. In some cases (such as in cancers or asbestosis) the latency period may be quite long and a worker may not necessarily correlate the disease with an earlier exposure. Workers should understand the toxicology of the chemicals with which they work to ensure they understand the symptoms and the latency period associated with exposure.





Section 5 - Chemical Hazard Assessment and Control

Hazard assessment and control is at the foundation of occupational health and safety and is a requirement for all work sites under Alberta OHS legislation.

What is a Hazard?

A hazard is any situation, condition, or thing that may be dangerous to the safety or health of workers.



Legislated Requirements

OHS Code, Part 1

How to identify chemical hazards in the workplace

As with all other hazards, chemical hazards that may be encountered in the workplace must be identified. The first step in a chemical hazard assessment is to list the job tasks that the worker performs, the chemicals a worker may work with or near, and environmental factors where the tasks are performed. Once the tasks have been identified, the potential risks presented by these exposures must be assessed and controls implemented to protect workers.

How to assess and control chemical hazards in the workplace



Step 1: List tasks that the worker performs and environmental factors where the worker is located.

Step 2: Identify and list the chemicals to which the worker may be exposed.

Step 3: Identify the potential for exposure to chemical substances through the various routes of entry (inhalation, absorption, ingestion, injection).

Step 4: Assess the hazard, evaluate potential exposure and determine the risk for exposure.

Step 5: Identify appropriate controls following the hierarchy of controls.

Continued on page 34.

Focus

Continued from page 33.



Focus

Step 6: Communicate the information to workers and the joint health and safety committee and provide training.

Step 7: Develop procedures to minimize worker exposure and provide training to workers on these procedures.

Step 8: Evaluate the effectiveness of controls and improve them as required.

For further information on Hazard Assessment and Control:



Resources

- » See Volume 1 – *Overview of Best Practices in Occupational Health and Safety in the Healthcare Industry*.
- » Access the Alberta Government's eLearning Program at: www.employment.alberta.ca/whs/learning/hazard/Hazard.htm.

The following checklist may be useful in evaluating your hazard identification and risk assessment processes.

Checklist – Are chemical hazards being properly identified and assessed?



Checklist

- ☐ Do hazard assessments include chemical hazards?
- ☐ Are there up-to-date inventories for all chemicals used at the work site?
- ☐ Are up-to-date MSDSs or other product safety information available for all substances used or stored in the workplace?
- ☐ Are all containers of chemicals properly labelled?
- ☐ Have exposure assessments been done?
- ☐ Are records of exposure monitoring maintained and reviewed?
- ☐ Are frontline workers/joint health and safety committee members actively involved in the hazard identification and risk assessment process to ensure accuracy and completeness?
- ☐ Are workers provided with training to ensure that they are aware of the hazards of the chemicals they work with or near?

Continued on page 35.

Continued from page 34.



- ☐ Are communications effective in ensuring that workers are aware of chemical hazards?
- ☐ Is there a process in place to ensure workers are notified if an engineering control is not functioning properly?
- ☐ Are hazard assessments repeated periodically or whenever changes to processes are made?

Checklist

Determination of appropriate controls

Controls that are chosen to protect workers should reflect the hierarchy of controls, with elimination of the hazard considered first, followed by engineering controls, then administrative controls, and PPE last. Appropriate controls must be provided to health care workers based on a hazard assessment and the use of controls must be required and enforced. Workers must be trained on the hazards and the proper use of controls. Controls must be properly maintained. Where PPE is listed as a control, appropriate types and sizes must be available; appropriate fit-testing, training and PPE maintenance are required.

Checklist – Are appropriate controls identified, supplied and used?



- ☐ Where possible, are mechanisms to eliminate or substitute the hazardous material identified?
- ☐ Are engineering controls identified and implemented?
- ☐ Are facilities and maintenance personnel aware of the purpose and mechanisms of ventilation as an engineering control?
- ☐ Is there a preventive maintenance program for engineering controls?
- ☐ Are workers involved in the determination and selection of hazard controls?
- ☐ Does the selection of controls take into account the route of entry?
- ☐ Are all required controls available where needed?
- ☐ Is the use of identified hazard controls required?
- ☐ Are workers provided with training on the proper use of controls?

Checklist

The following form is a sample that can be used for the process.

Hazard Assessment and Control Sheet (Sample)

- » List all identified hazards (and consider any worker health or sensitivity issues)
- » Identify the controls that are in place—engineering, administrative, PPE, or combination—for each hazard.

Job or Task	Potential or Existing Hazard	Hazard Risk Assessment	Controls in Place			Follow-up Action Required	Date and Person Responsible
			Engineering	Administrative	PPE		
Disinfection of surfaces	Exposure to chemical - disinfectant	Possibility of inhalation or skin contact with toxic chemical Probability, Severity, Frequency assessment leading to assessment of risk as High, Medium or Low	Automatic dilution equipment Substitution with less toxic disinfectant Ventilation of area	Purchasing controls - purchase dilute solutions Worker training Proper procedures including avoiding aerosolization	Chemical resistant gloves Safety goggles Protective clothing	Review new products to identify potential substitutes Ensure gloves are available in all sizes	Sue Brown - September 2009

List potential or existing hazards here.

Identify controls that are in place. If you wish you may identify them by type of control.

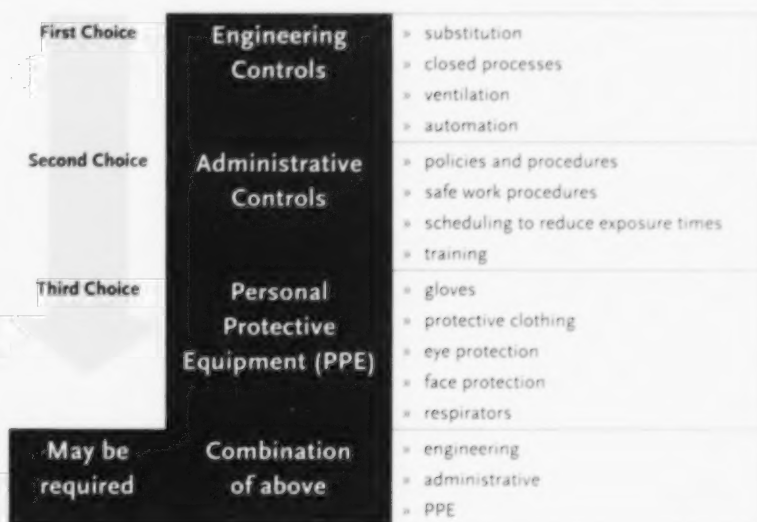
Identify if there is any follow-up action required, such as more training or PPE.

Fill in name of person who is responsible for implementing controls.

Eliminating and controlling hazards

All employers are required to eliminate or control hazards if they present a risk to workers. Once the hazards are identified, identify what measures (controls) can be put into place to eliminate or reduce those risks.

Whenever possible, hazards should be eliminated. If elimination is not possible, they must be controlled. Control means reducing the hazard to levels that do not present a risk to a worker's health or safety. Controls must be based on the identification and assessment of existing or potential hazards in the workplace. The hierarchy of controls specifies that hazards should be controlled by considering control methods in the order of elimination, engineering controls, administrative controls and lastly by the use of personal PPE.



In the hierarchy of controls, the highest level of control is directed at the source. For chemical hazards, this means eliminating the specific hazardous chemical altogether or replacing it with a less toxic chemical (substitution). Examples of good engineering controls include isolating the process to minimize exposure, local exhaust ventilation, and using equipment that is designed to minimize release of the chemical. Engineering controls, once designed, implemented and properly maintained, are not under the control of the worker, but are directed at the source of the hazard.

The next level of controls is administrative controls. Administrative controls include policies and procedures that establish expectations of performance, staff placement, required orientation and training, work schedules, and exposure monitoring programs in which regular monitoring of worker exposure levels takes place. Administrative controls focus on ensuring that the appropriate prevention steps are taken, that all proper work procedures are documented, that workers are trained to use the proper procedures, and that their use is enforced.

Did you know?

Administrative controls are considered less effective than engineering controls, as they require workers to actively engage the controls and managers to enforce them.



The third level of control in the control hierarchy is PPE. In the healthcare environment, PPE is often used in addition to other controls to further minimize the risk of exposure to chemicals. PPE is considered the third level of defence, as it only provides a barrier between the worker and the hazard. This control is the least desirable for two major reasons – first, it relies entirely on the employer's and the workers' knowledge of and compliance with proper selection and use of the equipment. Second, should the equipment fail, it is highly likely the worker would be exposed to the chemical. PPE commonly used in healthcare settings includes gloves, respirators, gowns, eye protection, shoe covers, and other protective clothing. Effective use of PPE requires that workers be trained in the selection, use, and limitations of PPE and in some cases (respirators) be properly fit-tested for their use.

Often combinations of controls that include all levels in the control hierarchy are employed to protect the worker. Of key importance is understanding the hazard, assessing the risk, and choosing and implementing effective controls. Higher risk hazards take precedence when developing controls, and in many cases, multiple controls are required to provide adequate protection.

Did you know?

CSA standards, including those related to controls, can be viewed on line at no charge as a result of a CSA – provincial government project to provide a pilot site to view CSA standards that are referenced in legislation. This site is accessed at ohsviewaccess.csa.ca/.



Engineering Controls

Many engineering controls are available for controlling the hazard at the source and along the path of transmission.

For chemical hazards, common engineering controls include:

- » Elimination.
- » Substitution.
- » Local exhaust ventilation.
- » General ventilation (only appropriate for non-toxic chemicals).
- » Isolation/enclosed processes.
- » Proper chemical storage.
- » Facility design.

Elimination

Elimination of a hazardous chemical from the healthcare workplace is always desirable but not always possible. For example, drugs must still be prepared and administered, anaesthetic gases must be used for surgeries, disinfectants are required when biological hazards are present, cleaning solutions are necessary to maintain hygienic conditions, and laboratory reagents are required for performing diagnostic tests. In some cases, exposures can be eliminated by transferring specific processes or activities to another facility, or areas within a facility where better controls are available.

Some examples of elimination of chemical hazards in healthcare:



- » No longer waxing floors to eliminate the need for wax strippers.
- » Purchasing fragrance-free products.
- » Using non-chemical means of sterilization (thermal).

Example

Substitution

Some chemicals used in the healthcare environment are chosen based on tradition or cost. In recent years, efforts have been made to find less hazardous alternatives to some of the chemicals commonly used.

Example

Some examples of substitution of chemical hazards in healthcare:



- » Replacing mercury-containing devices (manometers, thermometers) with non-mercury containing alternatives.
- » Using accelerated hydrogen peroxide-based disinfectants instead of glutaraldehyde.
- » Using hydrogen peroxide-based cleaners rather than chlorine-based cleaners.
- » Using sticky traps or mechanical traps rather than insecticides and rodenticides.

When substituting a chemical for one that is currently in use, it is critical to ensure that the new chemical does not have properties that may make it more toxic or more flammable, etc. A hazard assessment should be done whenever a new substance is introduced into the workplace. Substituted chemicals should be evaluated and compared based on toxicity, routes of entry, vapour pressure, flammability, method of use, safe disposal, storage considerations, etc.

Checklist

Checklist for choosing a substitute chemical (if the answer to these questions is yes, consider another alternative)



- ☐ Can the chemical be eliminated? (Is the process for using the chemical necessary?)
- ☐ Is the proposed alternative significantly less effective than the original chemical?
- ☐ Is the proposed alternative more toxic than the chemical currently in use?
- ☐ Is the proposed alternative a sensitizing agent, a carcinogen, or a substance that causes reproductive effects?
- ☐ Is the proposed alternative more flammable or combustible?
- ☐ Is the proposed alternative corrosive, reactive, or oxidizing?
- ☐ Are additional routes of entry possible for the proposed alternative?
- ☐ Are special controls necessary when using the proposed alternative (e.g. local exhaust ventilation, PPE, etc.)?

Continued on page 41.

Continued from page 40.



- ☐ Does the proposed alternative require further dilution to obtain a working solution?
- ☐ Will the proposed alternative require additional storage considerations?
- ☐ Will the proposed alternative pose disposal challenges?

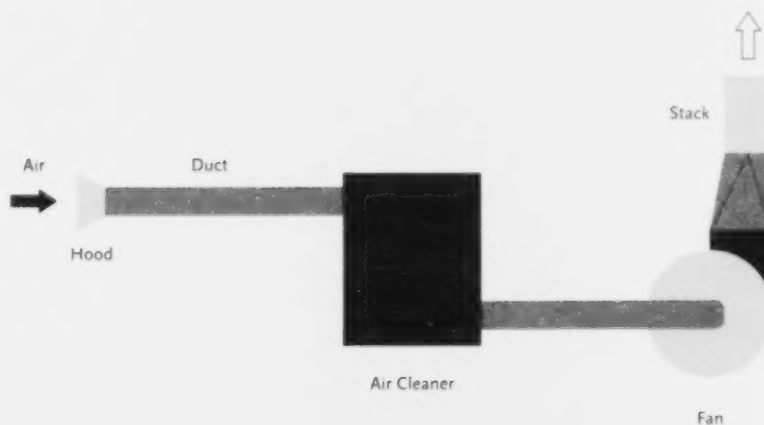
Checklist

More information can be obtained by consulting the Canadian Centre for Occupational Health and Safety "OSH Answers – Substitution of Chemicals: Considerations for Selection" available at www.ccohs.ca/oshanswers/chemicals/substitution.html.

Another excellent resource to assist with finding safe alternatives is Sustainable Hospitals, accessed at www.sustainablehospitals.org/cgi-bin/DB_Index.cgi.

Local Exhaust Ventilation

The most common engineering control used in healthcare to minimize exposure to chemicals in the air is local exhaust ventilation (LEV). LEV captures contaminants at the point where they are released or generated and mechanically removes them before workers can inhale them. The following figure³ outlines the major components of a basic local exhaust ventilation system.



Air containing contaminants is drawn through ductwork or tubing by means of a fan, removing it from the work environment and then expelling it to a safe location. Prior to being expelled, the air is sometimes decontaminated through filters.

³ From CCOHS Publication OSH Answers – Industrial Ventilation, found at www.ccohs.ca/oshanswers/prevention/ventilation/. Used with permission.

Examples of uses of local exhaust ventilation in healthcare:



Example

- » Scavenging systems are used in operating rooms to ensure that workers are not exposed to elevated levels of waste anaesthetic gases.
- » Dedicated local exhaust is used over instruments soaking in glutaraldehyde.
- » Methyl methacrylate is handled with local exhaust ventilation by dental technicians and workers making orthopaedic casts and prosthetic devices.
- » The ethylene oxide chamber is ventilated and ventilated exhaust hoods are placed above the sterilizer doors where ethylene oxide is used (surgical processing).
- » Hazardous drugs are prepared in biological safety cabinets equipped with local exhaust ventilation.
- » Diagnostic laboratories also use local exhaust ventilation extensively – chemical fume hoods are used for preparing reagents, biological safety cabinets are used when adding reagents to diagnostic samples, ventilated capture systems are used when working with solvents and fixatives in histology.
- » Ventilated tables are used in autopsy rooms.

All local exhaust systems must be inspected and maintained according to the manufacturer's instructions to ensure that they are functioning properly. Routine checks of the face velocity should be performed regularly on all fume hoods. Biological safety cabinets must also be checked regularly to ensure that they are functioning properly and certified annually by qualified persons. Chemicals should not be used in biological safety cabinets except in very minute quantities unless the cabinet vents 100% of the air outside the building via a duct.

Vacuums are forms of local exhaust ventilation that are used to capture particles in bags or central systems. Standard vacuums and central vacuum systems are sometimes used for cleaning up spilled or accumulated particulate material. High Efficiency Particulate Air (HEPA) filters are used with other equipment such as activated charcoal filters to filter the air to remove contaminants. It is important to handle HEPA vacuums with care to avoid chemical exposure when removing or replacing filters or bags and attaching nozzles.

For additional information on industrial ventilation, consult the publication by American Conference of Governmental Industrial Hygienists, titled *Industrial Ventilation: A Manual of Recommended Practice for Design*, 26th Edition.



Resources

www.acgih.org/store/ProductDetail.cfm?id=1905

General (Dilution) Ventilation

General ventilation refers to ventilation that is provided in a facility primarily for occupant comfort and to exchange air within work space with “fresh” air that includes some outdoor air. General ventilation acts to reduce concentrations of contaminants in the indoor air by dilution, by mixing with a supply of uncontaminated air. For these reasons, and others, general ventilation is not used for control of air contaminants that pose a health risk.

General ventilation systems serving buildings must be maintained regularly and inspected for conditions that could adversely affect the quality of air that is provided to work spaces.

Information about indoor air quality can be found in the Government of Alberta’s



Indoor Air Quality Tool kit available at: www.employment.alberta.ca/documents/WHS/WHS-PUB_gho15.pdf.

Resources

For additional information on indoor air quality, consult the ASHRAE Standard 62.1 Ventilation for Acceptable Indoor Air Quality accessible at www.ashrae.org/technology/page/548.

Isolation/Enclosed Processes

Isolating the source or location of the hazard helps to reduce exposure. When isolation is physical (separate rooms, closed doors, isolated locations, etc.), the isolated area must be maintained at a negative air pressure relative to the surrounding areas. This will allow air to flow into the isolated area, keeping the contaminant within the space. (Positive pressure would force the air out of the room and into the surrounding area.) Laboratories are examples of healthcare areas that are maintained under a negative air pressure.

Another method to effectively isolate an area where chemicals are used is to regulate traffic to the area. Notification of the hazard is usually placed at entrance points to the area, and only authorized personnel are permitted to enter the area. Examples of regulated areas include construction areas, areas where asbestos is being removed, laboratories, pharmacies, operating rooms, and some maintenance areas.

Enclosing processes where chemicals are used is another method of minimizing exposure. Examples of this control approach are found in endoscopy cleaning/sterilization equipment, diagnostic testing equipment, and sealing of biological safety cabinets during decontamination procedures.

Chemical Storage

An often-neglected engineering control is the proper storage of chemicals. Chemicals must be stored properly to reduce risks of fire and explosion, chemical reactions, and worker exposure. Chemical storage must consider local fire regulations that specify the types and quantities of specific chemicals that may be stored. Organizations should reduce the risks related to chemical storage by ensuring that only quantities of chemicals and sizes of containers that are necessary for the tasks are purchased and stored. The temptation to save money by purchasing large quantities should be discouraged, as these quantities have more stringent storage requirements and are often more difficult (and expensive) to dispose of than to purchase.

Some major reasons why chemicals are stored improperly include:



Information

- » An initial decision (when the area is designed) to purchase small quantities of chemicals that is later reversed for economic reasons, leading to the purchase of larger quantities that exceed the storage capabilities of the area.
- » Lack of space to accommodate storage facilities.
- » "Shared" storage facilities, with no one designated as responsible for ensuring proper storage.
- » Confusion as to how to store chemicals that have more than one hazard.
- » Lack of training/knowledge of chemical composition and reactivities.
- » Bad habits related to convenience.
- » Lack of a well thought out chemical storage plan.

An Alberta Government resource relating to safe storage of flammable chemicals is Workplace Health and Safety Bulletin – Handling and Storage of Flammable Materials at the Work Site accessible at www.employment.alberta.ca/documents/WHS/WHS-PUB_fexo02.pdf.



Alberta Building Code 2006 and Alberta Fire Code 2006 - www.municipalaffairs.alberta.ca/documents/ss/Code_info_sheet.pdf.

Many additional resources are available to assist organizations with identifying chemical storage requirements and determining safe storage guidelines.

Resources

www.mcgill.ca/ehs/laboratory/labsafety/#cli_4.
www.sciencelab.com/page/S/CTGY/22005.
www.mcg.edu/services/ehs/chemsafe/chemstor.htm.
www.emsc.nysed.gov/ciai/mst/pub/chemstorguid.html.
www.ehs.cornell.edu/lrs/manual/ch7.cfm#7.9.1
www.labsafety.com/refinfo/ezfacts/ezf181.htm.
membership.acs.org/c/ccs/safe_practices/storage_resources.htm.
www.uvm.edu/~esf/chemicalsafety/chemicalstorage.html.

Facility Design/Renovation

The best engineering control opportunity exists when facilities are being designed or renovated. Multi-stakeholder input in the planning stages enables facility designs that incorporate the best available engineering controls. For chemical hazard control, attention must be given to laboratory design, general ventilation, local exhaust ventilation, chemical storage capabilities, availability and location of emergency eye washes and showers, and “cleanability” of equipment and surfaces. A review of workflow and work practices will enable facility designers to identify important points of control to reduce worker exposure. It is also important to consider the travel path when transporting chemicals in the facility. General ventilation rates are specified based on room use and must comply with established standards.

During renovations, specific engineering controls are usually quite stringent and must be in place to reduce the potential of exposure of patients and workers to construction chemicals and debris. This is particularly critical if there is asbestos, mould or other hazardous materials in the construction area. The CSA Standard Z317.13-07,

Fundamentals of Infection Control During Construction, Renovation or Maintenance of Healthcare Facilities addresses necessary measures to help control biological risk, but many of the principles are also applicable to chemical risk. In addition, consideration must be given to the transfer of hazardous materials to non-construction areas through the ventilation or transportation pathways. It is a good practice to communicate possible hazards when there is a potential for exposure to staff and use administrative controls to avoid exposure to workers during the construction process.

To reduce the impact of new construction materials on healthcare workers, efforts should be made to choose materials of low toxicity and provide ample time for the off-gassing or dissipation of hazardous gases, dusts, or vapours.

Administrative Controls

WHMIS PROGRAM

A WHMIS program is an administrative control to reduce the risk of exposure to chemicals in the workplace and is a legal requirement for all employers who use controlled products in Alberta. To be effective, a WHMIS program must be relevant to the workplace, presenting information and training specific to the chemicals that are used in the workplace. The components of WHMIS include having current Material Safety Data Sheets for all products in the workplace, ensuring all products are appropriately labelled and ensuring that all workers are instructed on how to use the chemicals safely.

Is your WHMIS program working?



- ☐ Is there a policy that identifies WHMIS program elements and sets out roles and responsibilities for WHMIS implementation?
- ☐ Are there inventories of all controlled products available for all work areas?
- ☐ Is there a process to keep the inventories current?
- ☐ Is someone designated to be accountable for maintaining the inventory?
- ☐ Are there MSDSs for all controlled products listed in the inventories?
- ☐ Are the MSDSs current (issued within the past 3 years)?
- ☐ Is there someone designated to be accountable for obtaining MSDSs?
- ☐ Are the MSDSs readily available for all workers who may come into contact with the chemicals?
- ☐ Do all controlled products have a standardized WHMIS label on the container?
- ☐ Is there a process available for creating and using WHMIS workplace labels?
- ☐ Is there a process for obtaining labels if one is not on a container?
- ☐ Is there a requirement for introductory or generic WHMIS orientation for new workers?
- ☐ Is there a test or other mechanism to ensure comprehension of training?
- ☐ Is there job-specific WHMIS training available in departments that work with chemicals?
- ☐ Is periodic refresher WHMIS training available?
- ☐ Are WHMIS training records maintained?

Checklist

Resources

More information about WHMIS program requirements can be found in the WHMIS – Information for Employers and WHMIS – Information for Workers bulletins available at www.employment.alberta.ca.



For assistance in setting up a WHMIS program, the Canadian Centre for Occupational Health and Safety (CCOHS) provides detailed information on its website at www.ccohs.ca/oshanswers/legisl/intro_whmis.html.

Occupational Hygiene Program

To ensure effective identification and control of chemical hazards, an occupational hygiene program should be in place. An occupational hygiene program provides the framework for routine exposure monitoring of chemical hazards in the workplace that may reach exposure levels known to cause illness or injury. All employers must understand the legal responsibilities to identify and control hazards.

Potential Worker Exposure

The Alberta OHS Code requires employers to identify health hazards and assess worker exposure levels and communicate the results of the assessments.



Legislated Requirements

OHS Code Part 4, Sections 21 and 22

Focus

To assess the choice of controls, consider the following factors:



- a. Has the employer assessed whether exposures can be eliminated, controlled by substitution with a less toxic substance or other control measures? If these measures have not been implemented, what is the rationale for not doing so?
- b. What is best practice in other workplaces that use the substance or process? Are exposure levels at the workplace similar to those at other workplaces that use the substance or process?
- c. Are workers exposed to multiple substances at the workplace that may have combined effects?
- d. Are workers experiencing adverse health effects, even though exposure may be at or below the OELs?

Monitoring of chemical hazards requires an understanding of the principles of exposure monitoring, including proper sampling procedures, selection and use of sampling methods, and interpretation of results. If done for compliance purposes, exposure monitoring must be done by a competent person using specified methods. Three primary types of sampling are routinely used in the workplace for chemical monitoring.

Types of Monitoring



- » **Area Monitoring** – Used to measure the presence and level of contaminant in a work area. Example – Measurement of asbestos fibres in a renovation area.
- » **Personal Monitoring** – Used to measure the “dose” of contaminant a worker is exposed to by measuring near the breathing zone of the worker. Example – A passive sampler is worn in the breathing zone of workers to collect and measure anaesthetic gases in an operating room or recovery room.
- » **Biological Monitoring** – Used to evaluate exposure after the fact by measuring the presence of the contaminant or its metabolic products in the blood, body fluid or tissue of the worker. Example – Measurement of toluene in blood or its metabolic products in urine.

Information

Monitoring of workplace contaminants must follow standardized procedures, using appropriately selected methods, equipment and sampling strategies. Once the levels of contaminant have been measured, the results should be compared with legislated or well-recognized standards. OELs have been identified for many workplace chemicals and substances. OELs are the airborne concentrations of substances for which it is believed that nearly all workers may be repeatedly exposed on a day-to-day basis without suffering health effects. OELs are legislated standards which workplaces in Alberta must not exceed.

Legislated Requirements

Occupational Exposure Limits

Occupational Exposure Limits (OELs) can be found in the OHS Code, Schedule 1, Table 2.



Example

Healthcare facilities commonly monitor these chemicals



- » Ethylene Oxide (Central Processing).
- » Formaldehyde (Laboratories, Pathology, Morgue).
- » Glutaraldehyde (Laboratories, Endoscopy, Dialysis).
- » Anaesthetic gases (Operating Rooms, Recovery Rooms).
- » Solvents (Laboratories, Maintenance).
- » Asbestos (where required).

Legislated Requirements

Code of Practice

Employers must prepare a code of practice governing the storage, handling, use and disposal of any substance present in certain quantities and concentrations at a work site that is listed in Table 1 of Schedule 1. The procedures specified by a code of practice must be in writing and available to workers.



OHS Regulation Section 8, OHS Code Section 26

Example

Codes of Practice are sometimes required for the following chemicals in healthcare workplaces:



- » Asbestos.
- » Ethylene Oxide.

Further information about Alberta Government legislation related to chemicals in the workplace may be accessed through the Government website at www.employment.alberta.ca



Addition information about Occupational Hygiene may be found at the following websites:

www.cdc.gov/niosh/topics/chemical.html.

www.oshforeveryone.org/wsib/files/ont_wsib/certmanual/ch_o8.html.

www.crboh.ca.

Resources

Additional considerations for reducing risk of exposure

It is prudent to be aware of the need for modification of the work environment, conditions or required PPE for workers who may be medically vulnerable to the effects of some substances. Higher risk workers may include pregnant workers, workers with allergies or those who are sensitized to certain chemicals. Some common approaches to accommodate these workers include temporary reassignment to areas or tasks where the exposure potential is eliminated; work scheduling to reduce the amount of exposure, and changes to the PPE to accommodate limitations.

Work Scheduling

Another administrative control to reduce worker exposure to chemicals is the scheduling of work or workers. Scheduling of work aims to reduce the number of people who may be exposed to a chemical. Examples include scheduling some of the more intense cleaning of facilities or equipment to times when fewer workers are present, scheduling construction activities to reduce exposure, scheduling individual workers to reduce time of exposure, and rotating tasks to reduce exposure related to specific tasks.

Purchasing Processes

A proactive administrative control is the development and implementation of purchasing policies and processes that take into account the potential exposure of workers to hazardous materials and restricts/controls these products from entering the facility. Exposure control considerations should be an objective in purchasing processes.

Checklist

Are your purchasing processes supportive of reducing chemical exposures to workers?



- ☐ Are products evaluated by appropriate people prior to purchasing?
- ☐ Are those ordering supplies asked if the item ordered is the least toxic product that will have the desired effect?
- ☐ Are MSDSs requested and reviewed by a competent person for all new products purchased for the workplace?
- ☐ Are MSDSs available for all controlled products in the workplace?
- ☐ Are "working solutions" purchased rather than concentrated solutions?
- ☐ Are the volumes of chemicals ordered the smallest volumes necessary?
- ☐ Is stockpiling of chemicals avoided?
- ☐ Are the storage and ventilation requirements for using the product reviewed before purchasing it?

Health Surveillance and Medical Monitoring in the Workplace

Health surveillance encompasses two types of individual health assessments. The pre-placement assessment considers the worker's personal health status as it relates to potential workplace exposures. It is useful to identify if workers have any allergies or sensitivities to products that they may need to work with. Examples of allergens that may exist in healthcare workplaces are latex, certain soaps and cleaning agents, perfumes, fragrances and animal dander. Sensitivities to formaldehyde, glutaraldehyde, cleaning products and other chemicals have also caused reactions in HCWs ranging from mild to severe irritation. Workers should be informed about the chemicals used in their workplaces and asked if they have any allergies or sensitivities to these agents, or if they have restrictions with regards to wearing the required PPE. Workers who may be required to wear respirators must be assessed prior to fit-testing to ensure they are able to wear respirators. This often occurs at the pre-placement stage, but may occur at any time.

Medical assessment required for respirator fit-testing

Respiratory protective equipment must be fit-tested in accordance with CSA Standard Z94.4-02, Selection, Care and Use of Respirators, or a method approved by a Director of Occupational Hygiene. The CSA Standard requires that workers who use respirators be free from any physiological or psychological condition that may prevent them from using a respirator. In other words, the worker must not have a medical condition that, when combined with respirator use, could endanger his or her health and safety at the work site.

Evaluation of a worker's medical fitness to wear a respirator must be done before the worker is fit-tested. The evaluation should be appropriate to the level of respirator use and take into consideration:

- (a) The type of respirator being used,
- (b) the type and concentration of contaminant the worker will be exposed to,
- (c) the amount of time that the respirator must be worn, and
- (d) the activities the worker must do while wearing a respirator.

The employer should develop a procedure describing how the medical assessment requirement is met. An occupational health nurse or physician can assist the employer with this.

OHS Code Part 18, Subsection 250(1)

Another form of health surveillance is the on-going biological monitoring of workers who are exposed to certain chemicals or drugs in the workplace. If exposure monitoring indicates that workers are exposed to workplace chemicals (up to one-half the accepted occupational exposure limit), routine worker exposure monitoring should be established to provide information for health surveillance for affected workers. In some cases, healthcare organizations establish medical surveillance programs to monitor potential exposures to hazardous drugs. Detailed records of all monitoring must be maintained, with individual surveillance results also kept in workers' confidential medical files.

The US National Institute for Occupational Safety and Health⁴ has published the following recommendations for a medical surveillance program for workers handling hazardous drugs.

4 NIOSH – Medical Surveillance for Health Care Workers Exposed to Hazardous Drugs. Available at www.cdc.gov/niosh/docs/wp-solutions/2007-117/

Medical Surveillance Program – Hazardous Drugs



The elements of a medical surveillance program for hazardous drugs should include (at a minimum):

- » Reproductive and general health questionnaires completed at the time of hire and periodically thereafter.
- » Laboratory work, including complete blood count and urinalysis completed at the time of hire and periodically thereafter. Additional tests, such as liver function and transaminase tests, may be considered.
- » Physical examination completed at the time of hire and then as needed for any worker whose health questionnaire or blood work indicates an abnormal finding.
- » Follow-up for those workers who have shown health changes or have had a significant exposure (substantial skin contact, cleaning a large spill [a broken bag, leaking IV line], etc.).

Periodic health questionnaires and laboratory results should be looked at for trends that may be a sign of health changes because of exposure to hazardous drugs. If health changes are found, the employer should take the following actions:

Focus

- » Evaluate current protective measures:
 - Engineering controls (biological safety cabinets/isolators, ventilation, closed system transfer devices, and closed IV systems).
- » Compare performance of controls with recommended standards.
- » Conduct environmental sampling when analytical methods are available.
 - Policies for the use of PPE and worker compliance with PPE use and policies.
 - Availability of appropriate PPE such as double gloves, non-permeable gowns, and respiratory protection.
- » Develop plan of action that will prevent further worker exposure.
- » Ensure confidential notification of any adverse health effect to an exposed worker and offer alternative duty or temporary reassignment.
- » Provide ongoing medical surveillance of all workers at risk to determine whether the new plan is effective.

Spill Response Procedures⁵

All workplaces must be prepared to deal with accidental releases or spills of hazardous materials. For chemical hazards, each work area should have an inventory of all chemicals present as well as an MSDS for each product if one is available. Prevention of a spill is the most pro-active measure that can be taken. Most spills are the result of either improper storage or improper handling of chemicals.

To minimize the effects of a spill, emergency response procedures must be known by all workers in the area where chemicals are being used.

Part 7 of the Alberta OHS Code outlines responsibilities for emergency preparedness and response. Workers must be trained to follow the response procedures.



Legislated Requirements

Workers should have the opportunity to practice the responses so that the proper procedures are followed when an actual spill happens. A well-equipped spill response cart or kit must be available, as well as appropriate PPE.

In the case of antineoplastic drugs, prepared spill kits are often provided to care units, home care workers or patients who may be required to administer the drugs. Training must be provided to all individuals who may be expected to respond to a spill of a hazardous drug, and should include a discussion of the limitations of spill kits and PPE.

The design of an area can significantly minimize the ramifications of a spill. Proper drainage, a near-by emergency shower and eyewash, and appropriate fire extinguishing equipment can aid greatly in controlling the effects of the spill.

The most important aspect of spill response is the preparation and adherence to procedures for the specific chemicals used. MSDSs must be consulted for all chemicals that are used to determine proper response procedures. If MSDSs are not available for some substances, consult product information that is supplied with the substance (contact the manufacturer or supplier) or access information online, such as through the NIOSH Pocket Guide to Chemical Hazards (www.cdc.gov/niosh/npg/) or an online MSDS source e.g. www.hazard.com/msds/index.php. Spill response kits or carts may be made by the employer and specifically equipped to deal with the chemicals in use. Alternatively, ready-made kits or carts may be purchased from many chemical, laboratory, or safety supply companies. Appropriate PPE must be available for the clean-up of the spill.

⁵ Adapted from material in the Spotlight On Safety column in the Canadian Journal of Medical Laboratory Science, 2001. Used with permission.

A regular training program must be established for all personnel who may be involved in a chemical spill response. This training must include the care and use of personal protective equipment, as well as clean-up and disposal procedures. A spill response procedure and training program are necessary elements in an effective hazardous chemicals training program. Both preventing spills and responding properly to those that do occur contribute significantly to the safety of all staff, patients and visitors.

Information

The following chart⁶ identifies elements of a good spill response plan that every workplace that uses chemicals should address in advance, preferably by establishing written spill clean-up procedures:



1. Designated reporting process and identification of authority.
2. Spill containment and decontamination of affected personnel.
3. Assessment of size of spill and determination of those responsible for cleaning up the spill.
4. Step-by-step procedures for clean-up.
5. Available equipment, including personal protective equipment, for spill clean-up.
6. Training of personnel expected to participate in the clean-up.
7. Re-occupancy criteria after clean-up.
8. Disposal procedures for the chemical-contaminated waste, taking into account regulatory requirements.
9. Medical surveillance for personnel responsible for spill clean-up, as required.

6. Adapted from material in Controlling Chemical Exposures, Industrial Hygiene Fact Sheets; New Jersey Department of Health and Senior Services; www.nj.gov/health/surv/documents/ihfs.pdf

Exposure Follow-Up – Emergency Response Equipment

Two types of exposure follow-up are considered as administrative controls. The first is the provision of appropriate emergency response equipment to reduce the impact of the exposure. The second is the medical follow-up for workers who had a chemical exposure. In the first case, emergency response equipment usually refers to emergency eyewashes and showers that can provide sufficient water to dilute the contaminant before it can cause extensive damage. In any workplace where chemical exposure could pose a hazard to eyes and skin, emergency wash devices that deliver tepid water are required. Appropriate signage that is easily visible must be provided.

Emergency baths, showers, eye wash equipment

If a worker is present at a work site where chemicals harmful to the eyes or skin are used, the employer must ensure that the worker has immediate access at the work site to emergency baths, showers, eye wash equipment or other equipment appropriate for the potential level of exposure.



Legislated Requirements

OHS Code, Section 24

The most widely recognized standard for emergency eye washes is American National Standards Institute (ANSI) ANSI Z358.1-2009. (The Canadian Standards Association does not have a standard addressing this topic). The standard was developed by the International Safety Equipment Association (ISEA) and is available from ISEA, 1901 N Moore Street, Arlington, VA 22302 USA, www.safetysystem.org. The following table⁷ summarizes requirements of ANSI Z358.1-2004.

7 Modified from "A Guide to Eyewash and Safety Shower Facilities", North Carolina Department of Labor, Division of Occupational Safety and Health, 2008. Available at www.ncslabor.com/osh/etta/indguide/ig28.pdf

Information – Summary of ANSI Z358.1-2009

Equipment Type	Physical Features	Location	Maintenance	Training
Emergency Shower	Water column between 82" and 96" with 20" minimum diameter of column at 60" above surface. Flow rate of 20 gpm for 15 minutes is required. Enclosures, if used, require minimum 34" unobstructed diameter.	Accessible within 10 seconds. Path free from obstructions.	Plumbed units activated weekly to flush lines and verify operation. Self-contained units—visually inspect fluid for change and to supplement.	Required for all workers who might be exposed to hazardous material.
Eye Wash	Flow rate of 0.4 gpm for 15 minutes required. Water nozzles 33" to 45" above floor and 6" from wall or obstruction.	Accessible within 10 seconds. Path free from obstructions.	Plumbed units activated weekly to flush lines and verify operation. Self-contained units—visually inspect fluid for change and to supplement.	Required for all workers who might be exposed to hazardous material.
Personal Wash	Not addressed.	Protect against freezing or high ambient temperature (>38°C or 100°F)	Inspected and maintained in accordance with manufacturer's instructions.	Employees should be instructed in location, proper use and application.
Eye/Face Wash	Flow rate of 3.0 gpm for 15 minutes required. Water nozzles 33" to 45" above floor and 6" from wall or nearest obstruction.	Accessible within 10 seconds. Path free from obstructions.	Plumbed units activated weekly to flush lines and verify operation. Self-contained units—visually inspect fluid for change and to supplement.	Required for all workers who might be exposed to hazardous material.
Hand-held Drench Hose	Supplemental device. May be considered an eye wash or eye/face wash if meets the requirements of either.	Accessible within 10 seconds. Path free from obstructions.	Plumbed units activated weekly to flush lines and verify operation. Self-contained units—visually inspect fluid for change and to supplement.	Required for all workers who might be exposed to hazardous material.
Combination Units	Must meet physical requirement of component parts.	Accessible within 10 seconds. Path free from obstructions.	Plumbed units activated weekly to flush lines and verify operation. Self-contained units—visually inspect fluid for change and to supplement.	Required for all workers who might be exposed to hazardous material.

Medical follow-up of the exposed worker

A worker who has had a chemical exposure may require medical follow-up. Guidelines are available to provide information on the treatment and monitoring of workers with exposure to specific chemicals. Typically an Occupational Health Physician, Nurse or other health professional coordinates medical follow-up for workers. The NIOSH Pocket Guide to Chemical Hazards (2005 edition) is a searchable resource that provides information about many workplace chemicals found at www.cdc.gov/niosh/npg/. Information includes health effects, first aid after exposure, occupational hygiene sampling, and control measures. The US Agency for Toxic Substances and Disease Registry (ATSDR) has produced medical management guidelines for acute chemical exposures, which are available at www.atsdr.cdc.gov/MHMI/mmg.html#bookmark03.

Policies and safe work procedures for chemical use

Healthcare organizations should ensure that adequate policies for the purchase, storage, use and disposal of chemicals are developed and communicated to all applicable staff. Establishing and communicating policies sets the foundation for the organization's culture and expectations regarding the prevention of worker exposure to chemical hazards. Policies and procedures should be consistent with best practices and must ensure compliance with applicable legislation. Policies and procedures related to chemical hazards are best determined with input from departmental management, OHS, frontline workers, the joint health and safety committee, and other stakeholders (depending upon the subject of the policy or procedure). To ensure that policies and procedures are understood and enforced, adequate supervision must be provided and performance monitored. The following should be included in policies and procedures:

- » Management commitment to the protection of workers from exposure to chemical hazards through the establishment of chemical hazard control strategies, including the requirement to comply with OHS, WCB legislation and all other legislation applicable to the use, storage and disposal of chemicals.
- » Management commitment to provide appropriate resources including expertise, time for training and program development and for hazard controls (including PPE).
- » Designation of roles and responsibilities for chemical safety management.

- » An active OHS committee that reviews OHS programs and outcomes.
- » A requirement for systematic hazard identification and risk assessments for chemical hazards for all tasks/work sites.
- » A commitment to the use of controls following the hierarchy of controls (elimination, engineering, administrative and work practices, and PPE).
- » Safe work practices and procedures.
- » Development and communication of chemical safety procedures and policies.
- » Training programs.
- » Chemical purchasing, storage and disposal practices.
- » Chemical minimization policies.
- » An exposure monitoring program that includes routine and ad hoc monitoring.
- » An emergency exposure response plan, including spill response.
- » Reporting, investigation and follow-up process for workplace exposures; medical assessment and follow-up for chemical exposures.
- » A WHMIS program that is compliant with all aspects of the legislation.
- » Any required pre-placement or periodic health assessments related to chemical exposures.
- » Surveillance of HCW exposures, including data collection, analysis and communication of results; occupational health screening/surveillance.
- » Confidentiality and maintenance of health care worker medical records.
- » Respiratory protection code of practice, PPE selection, purchasing, management, cleaning/decontamination and use (including worker involvement, fit-testing, medical assessment for respirator use, record keeping, stocking and storage of PPE).
- » Contractor safety program to ensure any external service providers comply with the organization's OHS programs.
- » Input of OHS professionals into facility design/renovation, in particular with regards to chemical storage and disposal.
- » Procedures/programs to periodically inspect and maintain engineering controls.

- » Transportation of Dangerous Goods (TDG) Program, including use of International Air Transport Association (IATA) guidelines.
- » Procedures to periodically review and revise administrative controls.

To be effective, policies should be documented, authorized/ approved by the senior administrator(s), communicated to all workers and enforced.

Chemical Waste Handling and Disposal

Chemical wastes must be addressed with a good chemical waste management system. Municipal and/or provincial codes address appropriate disposal requirements and aim to reduce contamination, possible injuries, illness or reactions related to chemical exposures. Waste segregation is an important practice to reduce injuries and to reduce the cost of disposal. Chemical wastes that are awaiting disposal should be separated according to compatibility and accurately labeled. Training or information on safe handling should be accompanied when hazardous waste is transferred.

Additional Resources

For more detailed information, refer to the Alberta User Guide for Waste Managers, published by Alberta Environmental Protection. Available at www.environment.gov.ab.ca/info/library/7423.pdf.



Resources

The following are examples of sources of waste chemicals that may be found in many healthcare organizations and must be considered when developing safe chemical handling protocols.



- » Anaesthetic gases.
- » Laboratory chemicals.
- » Disinfection chemicals.
- » Radioisotopes (this covered in greater detail in Volume 4).
- » Hazardous drugs.
- » Cleaning and maintenance chemicals.
- » Waste chemicals found in discarded equipment.
- » Construction waste.

Example

A hazardous waste disposal program is based on a "cradle to grave" approach that ensures the safe handling of chemicals from their arrival in the facility to their disposal. Aspects of this approach include⁸:

- » Policies and procedures for all aspects of handling hazardous wastes from generation to final disposal, including selection criteria for third party contracted disposal services.
- » Training for any workers who may come into contact with hazardous materials and/or wastes.
- » Monitoring of compliance with the program's requirements.
- » Evaluation of the effectiveness of the program, with reports to the joint health and safety committee and those responsible for monitoring activities.

Is your chemical waste management program effective?



- ☐ Does your organization have required permits or licenses for chemical storage and disposal?
- ☐ Is someone designated as responsible for the waste management program?
- ☐ Are the individuals involved in waste management trained in all aspects of waste management?
- ☐ Does the program encourage minimization of the amount of chemicals in the facility?
- ☐ Does the program require the labeling of all chemicals, including waste chemicals?
- ☐ Does the program include communication of waste management practices (e.g. posted charts or flowcharts to assist in identifying how to dispose of specific waste chemicals)?
- ☐ Are there strict and well communicated policies as to what can be discarded in drains?
- ☐ Is there appropriate segregation of chemical wastes by type?
- ☐ Is there appropriate storage of chemical waste by type and risk?
- ☐ Is there adequate documentation for all transfer of chemicals and chemical wastes into and out of the facility?

Continued on page 63.

Checklist

⁸ Healthcare Hazard Control and Safety Management, James T. Tweedy, CRC Press, 2005; ISBN 978-1-57444-306-6.

Continued from page 62.



- ☐ Are chemical waste storage areas kept clean and not used for other purposes?
- ☐ Is the storage area adequately ventilated to control emissions?
- ☐ Are all those who use chemicals trained in proper disposal procedures?
- ☐ Are all those who transport chemicals or chemical waste trained in the Transportation of Dangerous Goods?
- ☐ Is the appropriate PPE available for use by those who work with waste chemicals?
- ☐ Is there an emergency response plan and appropriate equipment for accidental spills or discharges of waste chemicals?

Checklist

Training

Training in chemical hazards and controls must be provided to all HCWs. Each HCW must understand the facility's WHMIS and chemical safety programs and procedures as they relate to their job duties. For newly hired HCWs all relevant OHS policies and procedures must be provided to them before they start work. To ensure that HCWs understand and apply this information to their jobs, specific training must also be provided to address job-specific chemical hazards. Periodic refresher training to reinforce policies and procedures and introduce any new practices will benefit all HCWs. Competency assessments should be provided for all training, and training records should be maintained.

In addition to general WHMIS training, HCWs must be provided with information about specific chemicals they use in the course of their work.

Alberta OHS legislation covers harmful substances



Even though some chemicals and other hazardous products are exempt from WHMIS, Alberta's legislation addresses materials that are hazardous but are not controlled products. These hazardous materials are called "harmful substances." Employers have three responsibilities regarding harmful substances. They must:

Focus

- » Ensure that harmful substances or their containers are clearly identified.
- » Establish procedures to minimize worker exposure to these substances.
- » Train workers in those procedures and in the health hazards associated with exposure to the harmful substance.

From Workplace Health and Safety Bulletin – WHMIS Information for Employers Government of Alberta; Revised July 2009

Alberta Employment and Immigration provides more detailed specific information on a variety of chemicals. Of interest to HCWs are documents specific to the following chemical hazards, available at www.employment.alberta.ca.

- » Asbestos
- » Insecticides
- » Mercury
- » Methanol
- » Solvents
- » Lead
- » Isocyanates

Personal Protective Equipment

Personal protective equipment (PPE) is considered the lowest level of protection in the hierarchy of controls. This reflects the reliance on proper selection, fit, use and maintenance of the equipment by the organization and individual HCWs. PPE is often used in conjunction with other controls (engineering and administrative) to provide additional protection to workers. PPE is designed to protect the worker from exposure to chemicals by blocking access to the route of entry into the body.

Gloves, aprons and other protective clothing reduce exposure through the dermal (skin) contact route. Eye and face protection reduce exposure through skin and mucous membrane contact. Respirators reduce exposure to the respiratory system.

This section covers the selection and use of the most common PPE found in healthcare settings. Common factors that influence the selection of PPE include the characteristics of the chemicals workers may be exposed to, the route of exposure, the durability and appropriateness of the PPE for the required task, and the proper fit of the PPE. The employer should ensure that adequate quantities and sizes of PPE are available for HCW use.

Personal Protective Equipment

EMPLOYERS MUST:

- » Identify what PPE is required and when it is required based on the hazard assessment.
- » Ensure workers are trained in PPE use.
- » Ensure workers wear it/use it properly.
- » Ensure PPE is maintained and kept in good condition to perform the function for which it was designed.
- » Ensure PPE meets standards listed in the OHS Code.
- » Ensure the use of PPE does not itself endanger the worker.

WORKERS MUST:

- » Maintain and use appropriate PPE as required.
- » Follow employer procedures.

OHS Code Part 18

Gloves

The most frequently used PPE by HCWs to prevent exposure to chemicals is gloves. When choosing gloves, the following must be considered:

- » The nature and concentration of the chemicals.
- » The amount of time the gloves will be exposed to the chemical.
- » Degree of dexterity required to perform the task.
- » Extent of protection needed (to wrist or higher).
- » Decontamination and disposal requirements.

Chemical-specific factors that affect the selection of gloves are based on three glove characteristics. These are:

- » Breakthrough time – the time it takes for the chemical to pass through the glove material. This time is an indication of how long the glove can be safely worn.
- » Permeation rate – the rate the chemical travels through an intact glove.
- » Degradation rating – a rating scale that indicates the physical changes that may occur to the glove as a result of contact with a chemical. Physical changes may include stiffness, swelling, shrinking, hardening, cracking, softening, etc. These physical changes compromise the effectiveness of the gloves.

The following NIOSH publications are available to assist in selection of PPE:



NIOSH Pocket Guide to Chemical Hazards – www.cdc.gov/niosh/npg/default.html

A Guide for Evaluating the Performance of Chemical Protective Clothing – www.cdc.gov/niosh/90-109.html.

To choose the appropriate materials for gloves, compatibility charts are provided by glove manufacturers. A partial list of these charts is included here:

Resources

www.ehs.ufl.edu/Lab/CHP/North.pdf.

www.bestglove.com/site/chemrest/.

www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf.

www.microflex.com/Products/~ /media/Files/Literature/Microflex%20Chemical%20Resistance%20Guide.ashx.

www.kcprofessional.com/us/mkt/pselectortool/Disclaimer.aspx.

www.vwrsp.com/programs/safety/images/disposable_gloves.pdf.

Guidance for glove use for chemicals^{9,10}



- » Wear the appropriate gloves for the task when needed; for reusable gloves, follow the manufacturer's guidelines for care, decontamination and maintenance. Choose gloves resistant to holes and tears.
- » Ensure gloves fit properly and are of the appropriate thickness to offer protection; ensure adequate supplies of gloves in appropriate sizes.
- » Avoid using latex gloves (due to latex allergies).
- » Do not use worn or defective gloves.
- » Wash hands once gloves have been removed.
- » Disposable gloves must be discarded once removed. Do not save for future use.
- » Dispose of used gloves into the proper container. Have separate disposal locations for gloves contaminated with chemicals which pose a toxic hazard if mixed.
- » Non-disposable/reusable gloves must be washed and dried, as needed, and then inspected for tears and holes prior to reuse.
- » Remove gloves before touching personal items, such as phones, computers, pens and one's skin.
- » Do not wear gloves into and out of areas. If gloves are needed to transport anything, wear one glove to handle the transported item. The free hand is then used to touch door knobs, elevator buttons, etc.
- » Do not eat, drink, or smoke while wearing gloves. Gloves must be removed and hands washed before eating, drinking, or smoking.
- » If for any reason a glove fails, and chemicals come into contact with skin, remove the gloves, wash hands thoroughly and obtain first aid or seek medical attention as appropriate.

Information

9 OSH Answers- Chemical Protective Clothing
– Gloves; www.ccohs.ca/oshanswers/prevention/ppe/gloves.html

10 Glove Use in Laboratories; University
of Florida Chemical Hygiene Plan;
www.ehs.ufl.edu/Lab/CHP/gloves.htm

Eye and Face Protection

Eye protection is required if there is a possibility of chemical exposure to the eyes. The Alberta OHS Code, Part 18 – PPE addresses requirements related to eye protection.

Eye protection - Compliance with standards



If the worker's eyes may be injured or irritated at the work site.

EMPLOYER:

- » is required to ensure that the worker wears properly fitting CSA approved eye protective equipment.
- » appropriate to the work being done and the hazard involved.

For more information refer to: www.employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_pi18.pdf

If a worker must wear a full face piece respirator and the face piece is intended to prevent materials striking the eyes,

EMPLOYER MUST

- » ensure that the face piece:
 - (a) meets the requirements of CSA Standard Z94.3-07, *Eye and Face Protectors*, or CSA Standard Z94.3-02, *Eye and Face Protectors*, or
 - (b) meets the impact and penetration test requirements of section 9 of ANSI Standard Z87.1-2003, *Occupational and Educational Personal Eye and Face Protection Devices*, or ANSI Standard Z87.1-1989, *Practice for Occupational and Educational Eye and Face Protection*.

Contact lenses

AN EMPLOYER MUST

- » ensure that, if wearing contact lenses poses a hazard to the worker's eyes during work, the worker is advised of the hazards and the alternatives to wearing contact lenses.

OHS Code, Part 18, Section 229

Legislated Requirements

For most HCWs who use chemicals, goggles or face shields are necessary. In most cases, goggles are considered re-usable. All reusable PPE must be properly decontaminated and maintained. Selection of protective eyewear should take into account:

- » Level of protection required.
- » Comfort of the wearer.
- » Secure fit that does not interfere with vision or movement.
- » Ease of cleaning and disinfection.
- » Durability.
- » Compatibility with prescription glasses and other PPE that must be worn at the same time (e.g. respirators).

Goggles come as vented (direct or indirect) or non-vented. If there is a chance that a splash of chemical can occur, direct vented goggles must not be used. If there is a risk of exposure to chemical vapours, non-vented goggles are required. In certain situations, anti-fog lenses or tinted lenses may be required. As with all PPE, sufficient quantities and sizes of protective eyewear must be available to workers who will use them.

Advice on caring for goggles is provided by the Canadian Centre for Occupational Health and Safety¹¹



- » Clean your safety glasses daily. Follow the manufacturer's instructions. Avoid rough handling that can scratch lenses.
- » Scratches impair vision and can weaken lenses.
- » Store your safety glasses in a clean, dry place where they cannot fall or be stepped on. Keep them in a case when they are not being worn.
- » Replace scratched, pitted, broken, bent or ill-fitting glasses. Damaged glasses interfere with vision and do not provide protection.
- » Replace damaged parts only with identical parts from the original manufacturer to ensure the same safety rating.

Focus

¹¹ OSH Answers – Safety Glasses and Face Protectors; www.ccohs.ca/oshanswers/prevention/ppe/glasses.html, used with permission

Face protection is required if there is the potential for exposure to mucous membranes. Face shields are secondary protective equipment designed to protect the entire face from chemical hazards. In many situations, face shields are used in conjunction with goggles as face shields alone may not provide adequate eye protection.

Contact Lenses



Did you know?

There has been some controversy as to whether the wearing of contact lenses should be prohibited for workers who work with chemicals. An excellent discussion of this issue can be found on the CCOHS website article – Contact Lenses at Work¹². The bottom line is that risks must be identified and considered when determining whether contact lenses may be hazardous. The critical point is that contact lenses are NOT to ever be considered PPE. When there is the potential for eye exposure to chemicals, certified appropriate protective eyewear must be worn. In many cases, contact lenses may be worn under goggles.

Respirators

According to the Alberta Occupational Health and Safety Code 2009¹³, there is a duty to provide and use respiratory protective equipment (RPE) when a hazard assessment indicates that a worker may be exposed to airborne contaminants or exposed to an oxygen deficient environment. Employers are required to use engineering and administrative controls before using RPE (respecting the hierarchy of controls). Respirators may be required to protect HCWs from exposure to chemicals by inhalation.

¹² www.ccohs.ca/oshanswers/prevention/contact_len.html

¹³ Alberta OHS Code 2009, Part 18 – Personal Protective Equipment

Respiratory Protective Equipment (RPE)

Employers must determine the degree of danger presented by respiratory hazards and whether workers need to wear RPE if workers are, or may be exposed to, an airborne harmful substance. The employer must consider the nature and the exposure circumstances of the harmful material. If a hazard assessment identifies the need for RPE, the specific legislated requirements are outlined in the OHS Code, Part 18.

Some of the requirements include:

TRAINING

- » Employers must ensure that all workers receive appropriate education, instruction or training with respect to hazards that they may be exposed to and procedures and controls used to reduce exposure.

CODE OF PRACTICE

- » If respiratory equipment is used at a work site, an employer must prepare a written code of practice governing the selection, maintenance and use of the RPE.

APPROVAL OF EQUIPMENT

- » Employers must ensure that RPE required at a work site is approved by NIOSH or another standards setting and equipment testing organization, or combination of organizations, approved by a Director of Occupational Hygiene.

EFFECTIVE FACE SEAL

- » Employers must ensure that RPE that depends on an effective facial seal for its safe use is correctly fitted in accordance with CSA standard Z94.4-02 or a method approved by a Director of Occupational Hygiene.

OHS Act, Section 33 and OHS Code, Part 18

The OHS Code requires an organization using respirators to have a respiratory code of practice¹⁴ “governing the selection, maintenance, and use of respiratory protection equipment”. The employer is required to ensure that respirators are approved by NIOSH (or another standard setting and equipment testing organization approved by the Director of Occupational Hygiene). Respirators must be fit-tested in accordance with CSA Standard Z94.4-02 or a method approved by a Director of Occupational Hygiene. The CSA Standard Z94.4-02 requires that workers who must wear respirators be fit-tested at least every two years and trained in the proper use and maintenance of the respirators. Fit-testing requirements include a health assessment to ensure that HCWs are medically able to wear respirators. Depending upon required protection factors, fit-testing may be done using either quantitative or qualitative methods, but must be done for all respirators that are tight fitting. For tight fitting respirators that rely on proper sealing to the face, the wearer must be clean shaven where the respirator seals to the face.

Information

The two types of respirators are air-purifying and atmosphere supplying, based on their modes of operation¹⁵.



FEATURES OF AIR-PURIFYING RESPIRATORS (APRs)

- » Remove contaminants from the air as it is inhaled into the face piece by using a filter or absorbent.
- » Provide protection to wearer from inhalation of hazardous contaminants.
- » Are not to be used in oxygen-deficient or IDLH (immediately dangerous to life and health) atmospheres.
- » May be used when warning properties of the chemical enable detection below the OEL.

¹⁴ For more information, consult the Guideline for the Development of a Code of Practice for Respiratory Protective Equipment – PPE004 www.employment.alberta.ca/documents/WHS/WHS-PUB_ppe004.pdf

¹⁵ This section is modified from information found in *PPE Made Easy – A Comprehensive Checklist Approach to Selecting and Using Personal Protective Equipment*. Jeffrey O. Stull; Government Institutes 1998.

Two types of APRs are non-powered and powered. Non-powered APRs operate by the breathing action of the wearer. When the wearer inhales, air is drawn through the filtering material. The breath is expelled through an exhalation valve or through the filtering material. Powered APRs (PAPRs) have an air blower that blows air through a filter and supplies air to the face piece. Air purifying filters and canisters are capable of removing a wide range of particulate and chemical contaminants. It is important that the proper filtration/absorption media be selected to protect the worker from the specific substances and chemicals that they may be exposed to.

Types of atmosphere-supplying respirators include air-line respirators and self-contained breathing apparatus (SCBA). Air-line air respirators use hoses connected to air pumps, compressors or compressed air cylinders. A SCBA uses a source of air that is carried in a cylinder on the body of the wearer.

FEATURES OF ATMOSPHERE-SUPPLYING RESPIRATORS

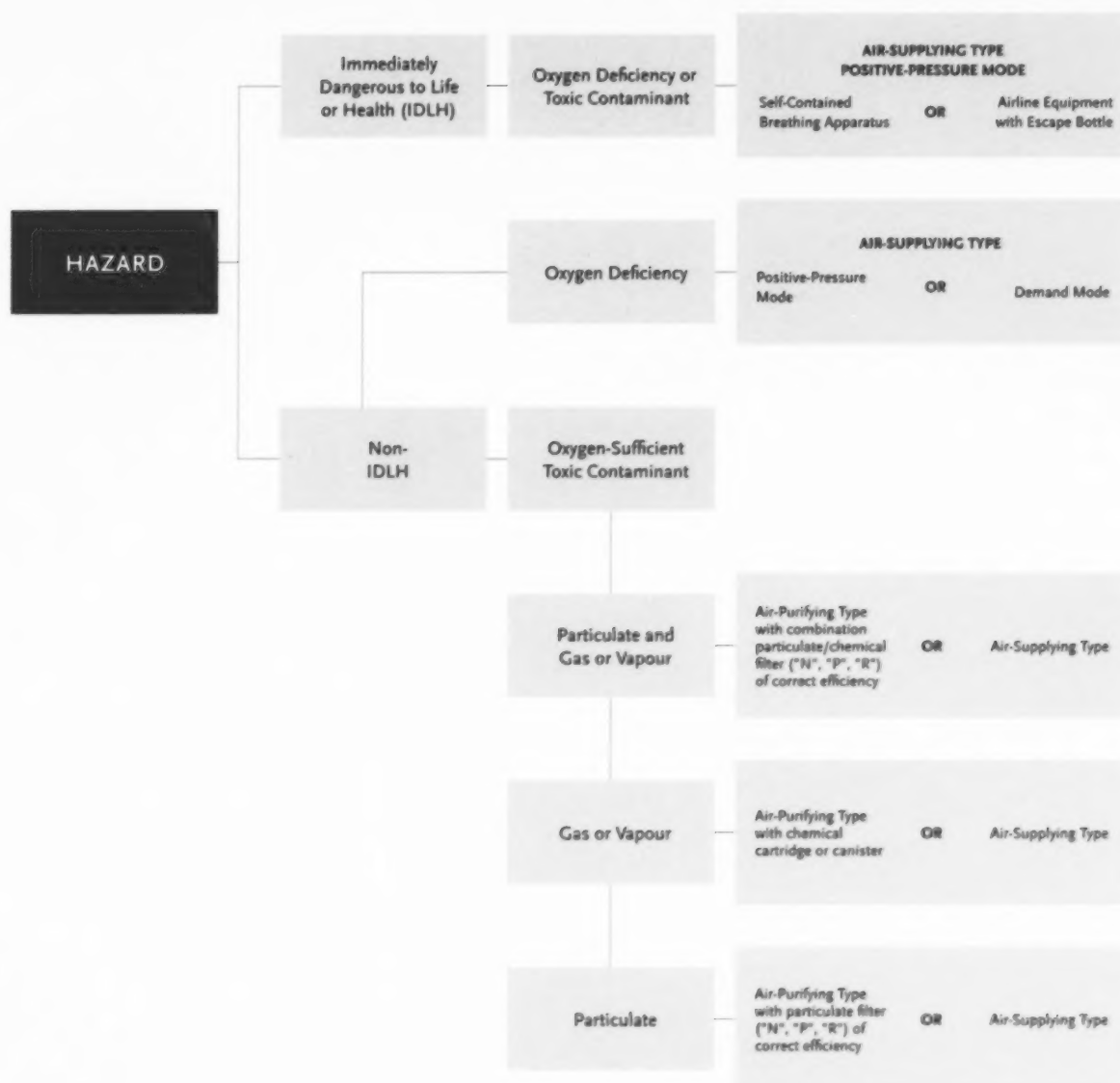
- » Provides the wearer with a source of air independent of the ambient air.
- » Can be used in oxygen deficient and IDLH atmospheres.



Did you know?

The following chart¹⁶ is useful in choosing the appropriate respirator type.

Figure 1 Choosing an Appropriate Type of Respiratory Protective Equipment



¹⁶ *Respiratory Protective Equipment: An Employer's Guide*; Alberta Human Resources and Employment; Workplace Health and Safety Bulletin PPE001-Breathing Apparatus; April 2005.

RPE Requirements



- » Employers are required to take reasonable measures to use engineering, or administrative controls to eliminate or reduce hazards before using respiratory protective equipment.
- » If respiratory protective equipment is used, employers are required to provide the appropriate equipment, maintain and store it properly, and ensure that it is properly fitted to the individual worker. Where the efficiency of respiratory protective equipment depends on a facial seal, the wearer must be clean shaven where the respirator contacts the face.
- » When selecting the appropriate respiratory protective equipment, the employer must consider the following factors:
 - The nature of the contaminant.
 - The concentration or likely concentration of any airborne contaminants.
 - The duration or likely duration of the worker's exposure.
 - The toxicity of the contaminants.
 - The concentration of oxygen in the work area.
 - The warning properties of the contaminant(s).
 - The need for emergency escape.
- » Respiratory protective equipment must be approved by NIOSH (National Institute for Occupational Safety and Health) or other standards setting organization approved by the Alberta Director of Occupational Hygiene.
- » Employers must ensure that workers using respiratory protective equipment are adequately trained.
- » Respiratory protective equipment must be properly fitted to the wearer's face. Employers must comply with the CSA Standard Z94.4-02 (or a method approved by a Director of Occupational Hygiene) when fit-testing respiratory protective equipment, and use the assigned protection factors (APFs) specified in that standard.
- » Employers must develop a Code of Practice governing the selection, maintenance and use of respiratory protective equipment.

Reproduced from *Respiratory Protective Equipment – An Employer's Guide*¹⁷ Alberta Government

Focus

¹⁷ Respiratory Protective Equipment: An Employer's Guide; Workplace Health and Safety Bulletin; Alberta Government, revised 2009. www.employment.alberta.ca/documents/WHS/WHS-PUB_ppe001.pdf

PROTECTIVE CLOTHING

Chemical protective clothing is available as gowns, aprons, uniforms, coveralls, foot covers and full body suits. The choice of protective clothing relies on an accurate hazard assessment. As with gloves, there is a wide range of available products to choose from. The selection of chemical protective clothing is based on:

- » The nature of the chemicals being used and the suitability of the protective clothing material.
- » The parts of body that may be exposed to the chemicals.
- » Whether protective clothing is worn over street clothes or in place of street clothes.
- » The comfort and flexibility of the clothing so that it does not interfere with the performance of the tasks or create other hazards.
- » Sizes available.
- » Whether the clothing is disposal or re-usable.
- » Cleaning, decontamination and disposal procedures.

Should protective clothing become contaminated with a chemical or damaged, the clothing must be removed and handled according to organizational procedures (disposal or proper decontamination). Residual chemicals such as acids on clothing may continue to present an exposure hazard. Workers must not wear clothing that is contaminated with chemicals home, as this may pose a danger to themselves and others.

Worker Decontamination

If a worker is contaminated by a harmful substance at the work site, the employer must ensure that only those items that have been properly decontaminated or cleaned are taken from the work site by the worker.

OHS Code, Part 4, Section 23

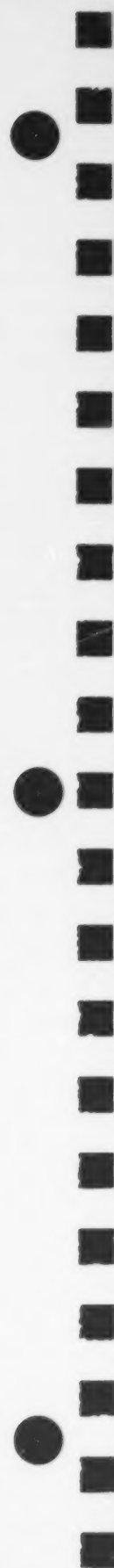
The following NIOSH database is available to assist in selection of appropriate chemical protective clothing:

Recommendations for Chemical Protective Clothing: A Companion to the NIOSH Pocket Guide to Chemical Hazards: Database -
www.cdc.gov/niosh/ncpc/ncpci.html.

Resources

Section 6

.....
Examples of Chemical Agents Frequently Encountered
in Healthcare – Health Effects and Controls
.....



Section 6: Examples of Chemical Agents Frequently Encountered in Healthcare – Health Effects and Controls

This section will provide a brief overview of selected chemicals used in healthcare workplaces. This is not a textbook and will not delve into details about each chemical. Rather it will present information about health effects, and suggested “best practices” for controlling exposures. Note that this list is not extensive or all-inclusive. While some of these chemicals are relatively common, several are used in very specialized areas or processes. In the control column, E, A and P are used to designate Engineering, Administrative and PPE controls. These controls are briefly summarized and the reader should link to the references provided for additional information. The proper choice of control measures must be based on a risk assessment for the specific tasks being performed. Safe work practices are administrative controls necessary for working with all harmful substances and educating workers in the practices is vital. Safe work procedures should be designed to:

- » Limit the worker’s exposure time.
- » Reduce contact with the substance through any route of exposure to the worker.
- » Ensure safe disposal of substances and disposable equipment that comes into contact with harmful substances.
- » Ensure safe handling and decontamination of reusable equipment.
- » Require the use of all designated controls.

Worker education is critical for safely handling harmful substances.

General Resources – Chemical Hazards

For more information about specific chemical hazards, consult the following resources:

NIOSH Pocket Guide to Chemical Hazards
(www.cdc.gov/niosh/npg/).

CCOHS Cheminfo (ccinfoweb.ccohs.ca/).

Alberta Workplace Health and Safety Bulletins
(www.employment.alberta.ca).



Resources

Chemicals used for cleaning and disinfection

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Alcohol hand sanitizers	Hand hygiene when water is not available and hands are not visibly soiled.	May cause skin dryness. Product is flammable.	A - Appropriate storage of product (away from ignition sources and incompatible products). Provision of hand cream to soothe hand dryness.	www.ottawa.ca/residents/health/emergencies/pandemic/hand/faq_gel_en.html employment.alberta.ca/documents/WHS/WHS-PUB_fex002.pdf www.municipalaffairs.alberta.ca/documents/ss/STANDATA/fire/fcb/97fcb026.pdf
Bowl cleaners	Cleaning toilet bowls & urinals	Many have acids and other toxic chemicals that are irritants and are corrosive to the eyes and skin. May react with other products to create hazardous products.	E - Substitution with less harmful product. A - Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education. P - Gloves and eye protection.	www.hercenter.org/hazmat/cleaningchems.cfm
Detergents	Cleaning a variety of surfaces	Possible eye, skin, and respiratory irritants. Some products may cause allergic dermatitis or contain sensitizers such as nickel or limonene. May react with other products to create hazardous products.	E - Substitution with less harmful product. Properly designed and maintained ventilation systems. Automatic diluting machines. A - Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education. Accommodation for sensitized workers or those with health issues. P - Gloves and eye protection.	www.hercenter.org/hazmat/cleaningchems.cfm www.museo.unimo.it/ov/fdrEdete.htm

Chemicals used for cleaning and disinfection continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Low Level Disinfectants	Chlorine compounds, alcohols, quaternary ammonium salts, iodophors, phenolic compounds, hydrogen peroxide used widely for disinfection; usually prepared and used in low concentrations.	Most are eye, skin, and respiratory irritants, particularly when concentrated. Some products may produce sensitization. Toxic effects depending on nature of chemical. May react with other products to create hazardous products.	E - Substitution with less harmful product. Properly designed and maintained ventilation systems. Automatic diluting machines. Closed systems. A - Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education. Accommodation for sensitized workers or those with health issues. P - Gloves and eye protection.	https://vprgsecure.web.virginia.edu/bio/ddisinfecant_summary.html www.cdc.gov/niosh/topics/chemical.html cms.hze-online.org/ee/hazmat/hazmatconcern/sssteril/ www.mtpinnacle.com/pdfs/disinfectant-selection-guidelines.pdf
Ethylene Oxide	Sterilization of medical devices. Exposure to ethylene oxide when removing items from the EtO sterilizer, moving items from the sterilizer to the aerator, and changing bottles of EtO gas.	Skin, eye and respiratory irritant. Toxic effects. Classified as a suspected human carcinogen. Reproductive effects. May cause skin sensitization. May cause frostbite by skin contact. Inhalation exposure may result from improper aeration of Ethylene Oxide chamber or equipment malfunctions.	E - Substitution with less harmful product. Ensure processes adequately allow for ventilation of chambers. Local exhaust ventilation. Use of closed processes. Preventive maintenance on process equipment. Facility design. Leak alarms. A - Safe work procedures including emergency release procedures. Provision of sufficient time for aeration. WHMIS program and maintenance of MSDSs. Worker education. Control access to work area and process equipment. <i>Continued on page 82.</i>	www.cdc.gov/niosh/89115_52.html www.osha.gov/SILTC/etools/hospital/central/central

Chemicals used for cleaning and disinfection continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
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			Continued from page 81. Continuous air monitoring in work and equipment service areas. Routine exposure monitoring. Accommodation for workers who are sensitized or may have health issues. P - Gloves, protective clothing (butyl apron), safety glasses, and appropriate respirator when changing cylinders or when engineering controls are insufficient.	
Floor care products (polishes, strippers etc.)	Floor maintenance	May cause skin, eye and respiratory irritation. May cause headaches and dizziness. Individuals with sensitivities may be more adversely affected May react with other products to create hazardous products. May be flammable.	E - Substitution with less harmful product. Properly designed and maintained ventilation systems. Automatic diluting machines. A - Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education. Accommodation for sensitized workers or those with health issues. P - Gloves and eye protection.	www.hercenter.org/hazmat/cleaningchems.cfm www.ccohs.ca/oshanswers/chemicals/corrosive/corrosiv.html www.ccohs.ca/oshanswers/prevention/corrosiv.html www.employment.alberta.ca/documents/WHMIS/WHMIS-PUB_ch013.pdf www.sustainablehospitals.org/cgi-bin/DB_Index.cgi

Chemicals used for cleaning and disinfection continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Formaldehyde	May be used to disinfect biological safety cabinets. Used in some cases for tissue preservation.	Eye and respiratory irritant and possible sensitizer. Toxic effects. Classified as a suspected human carcinogen. Ceiling Limit OEL exists. May react with other products to create hazardous products.	E - Substitution with less harmful product. Local exhaust ventilation. Enclosed processes. A - Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill and disposal procedures. Routine exposure monitoring. WHMIS program and maintenance of MSDSs. Worker education. Accommodation for sensitized workers or those with health issues. P - Gloves, eye protection, face shield, chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient.	www.osha.gov/SLTC/formaldehyde/index.html www.ccohs.ca/oshanswers/chemicals/chem_profiles/formaldehyde/health_for.html?print www.ccohs.ca/oshanswers/chemicals/chem_profiles/formaldehyde/personal_for.html www.sustainablehospitals.org/cgi-bin/DB_Index.cgi

Chemicals used for cleaning and disinfection continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Fungicides/ biocides	Cleaning areas where fungi may grow.	May cause skin, eye and respiratory irritation.	E - Mechanisms to reduce the growth of mould. Substitution with less harmful product. Properly designed and maintained ventilation systems. Local exhaust ventilation may be required when preparing solutions. A - Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures and provide worker education. WHMIS program and maintenance of MSDSs. P - Gloves, eye protection and protective clothing.	www.cdc.gov/niosh/docs/2007-150/ www.sustainablehospitals.org/cgi-bin/DB_Index.cgi
Glutaraldehyde	High level disinfection of medical devices. May also be used in tissue processing.	Contact allergen, may cause occupational asthma and respiratory and skin sensitization. Ceiling Limit OEL exists. Strong skin and respiratory irritant. May react with other products to create hazardous products.	E - Substitution with less harmful product. Properly designed and maintained ventilation systems. Local exhaust ventilation. Enclosed processes. A - Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education. Routine exposure monitoring. Accommodation for sensitized workers or those with health issues. P - Gloves, eye protection, face protection, and chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient.	www.osha.gov/Publications/3258-o8N-2006-English.html www.osha.gov/SLTC/etools/hospital/hazards/glutaraldehyde/glut.html www.cdc.gov/niosh/docs/2001-115/ www.sustainablehospitals.org/zcgi-bin/DB_Index.cgi

Chemicals used for cleaning and disinfection continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Hydrogen Peroxide	Sterilization of medical devices and surfaces	Skin, eye and respiratory irritant. Oxidizer. May react with other products to create hazardous products. Fire hazard.	E - Substitution with less harmful product. Properly designed and maintained ventilation systems. May require local exhaust ventilation. Enclosed processes. A - Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education. Accommodation for workers who are sensitized or may have health issues. P - Gloves, eye protection and chemical-resistant protective clothing. Respiratory protection based on risk assessment.	www.cdc.gov/niosh/npg/npgdo335.html
Ortho-phthalaldehyde (OPA)	High level disinfection of medical devices. Replaces glutaraldehyde containing disinfectants.	Eye and respiratory irritant and skin sensitizer. May cause skin discoloration. May react with other products to create hazardous products.	E - Properly designed and maintained ventilation systems. May require local exhaust ventilation. Enclosed processes. A - Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including disposal and spill procedures, and keeping soaking containers closed at all times. WHMIS program and maintenance of MSDSs. Worker education. Control access to work area. Exposure monitoring. Accommodation for sensitized workers or those with health issues. P - Gloves, eye protection, face shield and chemical-resistant protective clothing.	www.mtpinnacle.com/pdfs/Cydex.pdf www.sterrad.com/Customer_Support/user_resources/msds/cidexopa_msds.pdf www.sustainablehospitals.org/cgi-bin/DB_Index.cgi

Chemicals used for cleaning and disinfection continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Proteolytic enzymes	Decontamination of biological material from endoscopes and surgical devices.	Sensitization of skin. Skin, eye and respiratory irritant.	E - Substitution with less harmful product or process. Enclosed processes. A - Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education. P - Gloves, face splash shields or procedure masks, moisture resistant gowns.	
Soaps and waxes	General cleaning and floor maintenance.	May cause skin and eye irritation. Some waxes may be a respiratory irritant if ventilation is insufficient. May react with other products to create hazardous products.	E - Elimination of waxes. Substitution with less harmful product. Design and maintenance of ventilation systems. A - Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures. Scheduling of floor care activities to reduce exposure to workers in the area, particularly those with sensitivities. WHMIS program and maintenance of MSDSs. Worker education. P - Gloves and eye protection when skin or mucous membrane contact is possible.	www.hercenter.org/hazmat/cleaningchems.cfm

Chemicals used in diagnostic tests

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Acids/bases	Reagents in a variety of diagnostic procedures.	Exposure may occur from skin contact, mucous membrane contact or inhalation. Corrosive causing destruction of tissue on exposure. May be a skin, mucous membrane, eye and respiratory system irritant. Effects may be delayed. Many are oxidizers and may not be stored with flammable products.	E - Elimination where possible. Substitution with less harmful products. Properly designed and maintained ventilation systems. Local exhaust ventilation may be required including fume hoods. Enclosed and automated processes. A - Purchase products in small quantities with the highest dilution that is appropriate for the task. Safe work procedures including using proper handling techniques, using mechanical transfer devices, and spill procedures. Appropriate storage of products to decrease exposure. Maintain inventory of products and remove unused products. WHMIS program and maintenance of MSDSs. Worker education. P - Tight-fitting eye protection (indirect vented goggles), face shields, chemical resistant aprons, closed-toed shoes and appropriate gloves selected based on the nature of acid/base. Respiratory protection based on hazard assessment.	www.ee.byu.edu/cleanroom/acid_safety.phtml www.lbl.gov/ehs/chsp/html/acids_bases.shtml

Chemicals used in diagnostic tests continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Alcohols	Disinfection for some surfaces and as a reagent in some procedures.	Skin, eye and respiratory irritant. Flammable. Central nervous system depressant.	E - Substitution with less harmful products. Maintain adequate general ventilation. Enclosed and automated processes. Grounded and bonded transfer equipment. A - Purchase of products in small quantities with the highest dilution that is appropriate for the task. Safe work procedures including spill procedures. Appropriate storage of products to decrease exposure and reactions. Maximum storage volumes allowed based on flammability and container material. Maintenance of an inventory of products and removal of unused products. WHMIS program and maintenance of MSDSs. Worker education. P - Gloves and eye protection depending upon the products used, concentration and tasks. Respiratory protection based on hazard assessment.	www.ee.byu.edu/cleanroom/solvent_safety.phtml www.cdc.gov/NIOSH/NPG/npgdo359.html www.employment.alberta.ca/documents/WHMIS/WHMIS-PUB_fex002.pdf

Chemicals used in diagnostic tests continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Organic solvents	Reagents in a variety of diagnostic procedures; also used extensively in maintenance areas; examples include toluene, alcohols, acetone, xylene, etc.	May cause a variety of effects including skin, eye and respiratory effects, neurological effects (central nervous system depressant) and acute and chronic organ damage. May be absorbed through skin. Fire hazard related to use and storage.	E - Elimination of solvent use. Substitution of solvent with less harmful products. Properly designed and maintained ventilation systems. Local exhaust ventilation may be required including fume hoods. Enclosed and automated processes. Ground and bond transfer equipment. A - Purchase of products with the highest dilution that is appropriate for the task. Safe work procedures including spill, proper handling and disposal procedures. Appropriate storage of products to decrease exposure and minimize fire and reaction hazards. Maximum storage volumes allowed based on flammability and container material. Maintenance of an inventory of products and removal of unused products. Routine exposure monitoring. WHMIS program and maintenance of MSDSs. Worker education. P - Gloves, eye protection and chemical-resistant protective clothing. Respiratory protection based on hazard assessment. Proper footwear (non-porous with closed heel and toe).	www.ccohs.ca/oshanswers/chemicals/flammable/flam.html www.ccohs.ca/oshanswers/prevention/flammable_general.html www.ee.byu.edu/cleanroom/solvent_safety.phtml www.employment.alberta.ca/documents/WH5/WH5-PUB_cho13.pdf www.employment.alberta.ca/documents/WH5/WH5-PUB_fex002.pdf www.sustainablehospitals.org/cgi-bin/DB_Index.cgi

Chemicals used in diagnostic tests continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Toxic chemicals Research laboratory chemicals	Wide variety of chemicals used in laboratories for testing and research – may include stains, fixatives, and other reagents. Geno-reactive/geno-toxic and mutagenic chemicals (e.g. ethidium bromide, osmium tetroxide) are used in some specialized laboratories.	Depending upon the toxicology of specific chemical, exposure can be through any route of entry and affect most human organs. Other effects may include reproductive effects, carcinogenicity, mutagenicity, teratogenicity etc.	E - Elimination where possible. Substitution with less harmful products. Local exhaust ventilation may be required including fume hoods. Enclosed and automated processes. A - Safe work procedures and provide worker education. Safe work procedures and education are critical for safe handling with hazardous materials. Exposure monitoring where applicable. WHMIS program and maintenance of MSDSs. Accommodation for workers with special needs (pregnant workers, persons with sensitivities). P - PPE as required based on hazard assessment. Refer to individual MSDSs.	www.safety.seas.harvard.edu/chp-das.html www.ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lscemosha.htm www.ehrs.upenn.edu/programs/labsafety/labsafety_manual.html www.ehs.cornell.edu/lrs/manual/index.cfm www.cdc.gov/niosh/database.html www.hazard.com/ www.siri.org/msds/

Chemicals used in treatment

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
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Anaesthetic gases¹⁸	Used to induce anaesthesia by inhalation in operating theatres; may off-gas in recovery rooms and ICUs.	Exposure is primarily through inhalation. Neurological and reproductive effects. Central nervous system depressant.	E - Substitution with less harmful products. Properly designed and maintained ventilation systems. Scavenging systems to control fugitive emissions. Properly designed patient masks and induction systems to reduce emissions. A - Safe work procedures. Preventative maintenance on equipment and systems. Routine exposure monitoring. Worker education. P - Respiratory protection based on hazard assessment.	www.ccohs.ca/oshanswers/chemicals/waste_anesthetic.html

¹⁸ Information from linked sources plus Essentials of Modern Hospital Safety, Volume 3, William Charney, ed. 1994. CRC Press, ISBN 1-56670-083-3.

Chemicals used in treatment continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Antineoplastics,¹⁹ cytotoxic and other hazardous drugs, antibiotics, aerosolized drugs, hormonal drugs	Antineoplastics used to treat cancer and other neoplasms; antibiotics and aerosolized drugs used to treat infections. Examples – cancer treatment drugs, aerosolized pentamidine or ribavirin.	May be mutagenic or carcinogenic, teratogenic or have reproductive effects, or affect target organs. Exposure may occur through inhalation, skin contact, skin absorption, ingestion, or injection. Inhalation and skin contact/absorption exposures may occur when reconstituting or making up the drug, administering the drug, handling contaminated materials, and disposing of drugs or contaminated materials, including patient waste.	E - Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices. Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items. A - Safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE. Accommodation for workers with special needs (pregnant workers, persons with sensitivities or other health issues). P - Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.	www.cdc.gov/niosh/docs/2004-165/2004-165b.html#j www.cdc.gov/niosh/topics/hazdrug/ www.cdc.gov/niosh/docs/2004-165/ www.cdc.gov/niosh/topics/antineoplastic/ www.mtpinnacle.com/pdfs/safe-handling-hazardous-drugs.pdf www.osha.gov/dts/osta/otm/otm_vi/otm_vi_2.html

¹⁹ Information from linked sources plus Essentials of Modern Hospital Safety, Volume 3, William Charney, ed. 1994, CRC Press, ISBN 1-56670-083-5.

Chemicals used in maintenance activities

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
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Battery acid	Acid, typically sulphuric, is contained in a wide variety of equipment and vehicle batteries.	Exposure may occur from skin contact, mucous membrane contact or inhalation. Corrosive causing destruction of tissue on exposure. May be a skin, mucous membrane, eye and respiratory system irritant. Effects may be delayed.	E - Adequate ventilation, particularly in battery charging areas where hydrogen gas (a flammable gas) may be released during charging. Enclosed and automated processes. A - Isolation and dedicated work area where batteries are handled. Safe work procedures including spill procedures. Worker education. P - Tight fitting eye protection (indirect vented goggles), face shields, chemical resistant aprons, closed-toed shoes and appropriate gloves selected based on the nature of acid/base. Respiratory protection based on hazard assessment.	www.ccohs.ca/oshanswers/chemicals/corrosive/corrosiv.html www.ccohs.ca/oshanswers/prevention/corrosit.html www.cdc.gov/niosh/npg/npgdos77.html
Fungicides and biocides	Cleaning areas where fungi may grow; used in ventilation humidification systems to inhibit the growth of bacteria.	May cause skin, eye and respiratory irritation.	E - Substitution with less harmful product. Adequate ventilation. Local exhaust ventilation may be required when preparing solutions. A - Ready to use concentrations to minimize handling. Safe work procedures. Worker education. WHMIS program and maintenance of MSDSs. P - Gloves, eye protection and protective clothing. Respiratory protection based on hazard assessment.	www.cdc.gov/niosh/docs/2007-150/ www.hse.gov.uk/pubns/biopestindex.htm

Chemicals used in maintenance activities continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Glues	Joining wood or other materials together. Examples contact adhesives, epoxy glues, formaldehyde resin glues, and instant bonding glues.	Depending on types of glues, exposure could result in skin, eye and respiratory irritation. Other effects may include contact dermatitis, sensitization, skin fusion, and toxicity to specific organs.	E - Substitution with less harmful products. Avoidance of formaldehyde-based glues and choice of water-based rather than solvent based glues. Properly designed and maintained ventilation systems. Local exhaust ventilation. A - Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education. Airing of products which produce off-gassing prior to installation in a well-ventilated area. Appropriate use and storage of products to decrease fire hazards. P - Gloves and eye protection. Respiratory protection may be required for some applications based on the hazard assessment.	www.angelfire.com/nc/conally/hazard.html www.elcosh.org/docs/hazard/chemical_adhesives.html

Chemicals used in maintenance activities continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
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Organic solvents	Used in many cleaning, degreasing solutions, paint thinners, etc.	May cause a variety of effects including skin, eye and respiratory effects, neurological effects (central nervous system depressant) and acute and chronic organ damage. May be absorbed through skin. May be flammable.	E - Elimination of solvent use. Substitution of solvent with less harmful products. Adequate ventilation. Local exhaust ventilation may be required including spray booths. Enclosures and automated processes. Grounded and bonded transfer equipment. A - The purchase of products with the highest dilution that is appropriate for the task. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education. Appropriate storage of products to decrease exposure and minimize fire hazards. Maximum storage volumes allowed based on flammability and container material. Maintenance of inventory of products and removal of unused products. Routine exposure monitoring. P - Gloves, eye protection and solvent-resistant protective clothing. Respiratory protection based on hazard assessment.	www.ccohs.ca/oshanswers/chemicals/flammable/flam.html www.ccohs.ca/oshanswers/prevention/flammable_general.html www.ee.byu.edu/cleanroom/solvent_safety.phtml www.employment.alberta.ca/documents/WHS/WHS-PUB_fex002.pdf www.sustainablehospitals.org/cgi-bin/DB_Index.cgi

Chemicals used in maintenance activities continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Paints	Building maintenance and renovation activities; may be applied as a solid, aerosol or liquid.	Paints are composed of pigments and organic solvents that may cause skin, eye and respiratory irritation. May cause neurological effects and central nervous system depression. Isocyanates in urethane paints are respiratory sensitizers. Pigments often contain heavy metals that are toxic to specific organs. Exposures are typically greater with spray paints.	E - Substitution with less harmful products (water based products). Properly designed and maintained ventilation systems. Local exhaust ventilation may be required including spray booths. Enclosed and automated processes. A - The purchase of appropriate quantities of products. WHMIS program and maintenance of MSDSs. Worker education. Appropriate storage of products to decrease exposure and minimize fire hazards. Safe work procedures. Maintenance of an inventory of products and removal of unused products. Scheduling work to decrease workers' exposures. P - Gloves, eye protection and protective clothing. Respiratory protection may be required for some applications.	www.employment.alberta.ca/documents/WH5/WH5-PUB_choo4.pdf www.esao.on.ca/downloads/pamphlet_pdfs/workplace_painting.pdf

Chemical Wastes

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Laser plumes / Surgical smoke	By-product of the use of lasers and electrocautery devices for surgical procedures.	Plumes may contain toxic vapours and gases, including benzene, formaldehyde, and hydrogen cyanide (in addition to biological hazards). Depending on waste by-products, exposure may cause respiratory and eye effects, and may be toxic to specific organs.	E - Well-designed smoke evacuation systems situated in proximity to plume. Availability of smoke evacuation systems in all areas where plumes can be generated. Adequate ventilation. A - Requirement to use smoke evacuation systems whenever any sized plume is generated. Safe work procedures. Education of workers in the nature of the hazard. Preventative maintenance of systems. Adherence to CSA Standard Z305.13-09, Plume scavenging in surgical, diagnostic, therapeutic and aesthetic settings. P - Gloves, eye, face and respiratory protection based on hazard assessment.	www.osha.gov/SLTC/etools/hospital/surgical/surgical.html#LaserPlume www.cdc.gov/niosh/hc11.html
Other chemical waste	Waste chemicals can be generated in any area where chemicals are used, including used protective clothing.	Exposure routes of entry and health effects are dependent upon the nature of waste chemicals. Mixed wastes may pose multiple hazards.	E - Designated waste storage and collection areas. Adequate ventilation. Use of bonding, grounding and explosion control. A - Appropriate storage of products to decrease exposure and minimize fire hazards and chemical reactions. Policies and procedures for safe chemical disposal. Education of workers in the nature of the hazard. P - As required based on specific hazard assessment.	www.employment.alberta.ca/documents/WHS/WHS-PUB_fex002.pdf

Chemical Wastes continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Waste anaesthetic gases	Used to induce anaesthesia in operating theatres; may off-gas in recovery rooms and ICUs.	Exposure is primarily through inhalation. Neurological and reproductive effects.	E - Substitution with less harmful products. Properly designed and maintained ventilation systems. Control of fugitive emissions with scavenging systems. Properly designed patient masks and induction systems to reduce emissions. A - Safe work procedures. Preventative maintenance on equipment and systems. Routine exposure monitoring. Worker education.	www.ccohs.ca/oshanswers/chemicals/waste_anesthetic.html

Other chemicals and substances

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Asbestos	Used for fire protection and insulation and in many older building products. Asbestos is often found in older facilities, in a variety of building materials including fireproofing materials, pipe and vessel insulation, floor coverings etc.	Exposure to fibres through inhalation if asbestos containing material is disturbed. Carcinogenic and may cause lung disease. Workers involved in abatement are at highest risk.	E - Isolation of abatement areas. Enclosure and encapsulation of asbestos containing materials as appropriate. Elimination of asbestos materials. Substitution with less harmful product. Contracting out abatement activities to qualified contractors. A - Development of an asbestos management plan in compliance with legislative requirements. Identification of asbestos containing materials. Safe work procedures including spill procedures. Education of workers in the nature of the hazard. An Asbestos Worker training course may be required depending on the nature of the work being done, in accordance with OHS legislation. Performance of air sampling as required. P - PPE as required by hazard assessment - may include protective clothing, face/eye protection, respiratory protection.	www.employment.alberta.ca/documents/WHS/WHS-PUB_cho19.pdf www.cdc.gov/niosh/npg/npgdoo41.html



Other chemicals and substances continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Chemicals used in terrorist activities	A variety of chemicals that could be used in terrorist activities. May be encountered while caring for exposed patients and result in contamination of the healthcare environment.	Depending upon the nature of the chemical, its concentration and route of exposure, may cause blistering, choking, neurological or blood system effects.	E - Properly designed and maintained ventilation systems. Local exhaust ventilation. Isolation of areas where contamination may be present. Provision of adequate decontamination facilities. Provision of antidotes if available. A - Development and implementation of a chemical, biological, radiological and nuclear response (CBRN) plan. Education of workers in the nature of the hazard and emergency procedures. P - PPE as detailed in the CBRN plans.	www.ajph.org/cgi/reprint/91/5/718.pdf www.nae.edu/NAE/pubundcom.nsf/weblinks/CCOZ-66JRHZ/\$file/chemical%20attack%2006.pdf
Compressed gases	Commonly used for patient treatment i.e. oxygen, nitrous oxide. Also commonly used in maintenance activities.	Asphyxiation, anaesthetic effects. Toxicity is dependant on chemical products. Other hazards include explosions, fire hazards, flying projectiles, and release of gas. Cryogenic gases may also cause skin damage through freezing.	E - Substitution with less harmful product. Adequate ventilation. Proper storage of cylinders. A - Appropriate store of products to decrease exposure and minimize fire and explosion hazards. Safe work procedures including transportation. WHMIS program and maintenance of MSDSs. Worker education. Good housekeeping. P - PPE based on hazard assessment.	www.ccohs.ca/oshanswers/chemicals/compressed/compress.html www.ccohs.ca/oshanswers/prevention/comp_gas.html www.chem.ubc.ca/safety/safety_manual/hazard_chem_gases.shtml

Other chemicals and substances continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Illicit drugs and chemicals used to make illicit substances	A variety of chemicals found in marijuana growing operations and in the production of illegal drugs (such as methamphetamine).	Most exposures are to public health and law enforcement officers, pre-hospital and emergency room care providers; however, home care providers may be exposed if providing services to homes which produce these substances. Exposures are primarily through inhalation and skin contact. Other hazards include chemical reactivity and explosions.	E - Isolation of abatement areas. Contracting out abatement activities to qualified contractors. A - Education of workers in the nature of the hazard. Safe work procedures. Coordination of response procedures with first responders and law enforcement. Limitation of workers in the area to those deemed necessary. P - PPE as required based on hazard assessment which may include protective clothing, gloves, eye and face protection and respirators. High level PPE may be required including full containment suit and self contained breathing apparatus.	www.ohsonline.com/Articles/2006/11/Coping-with-Meth-Lab-Hazards.aspx www.health.state.mn.us/divs/eh/meth/lab/jhughart.pdf http://www.bcmj.org/claandestine-drug-laboratories-public-and-environmental-health-aspects
Isocyanates	Used in a variety of products including insulation, paint products, some glues and adhesives, and anti-corrosive chemicals. May also be used when making artificial limbs.	May cause respiratory and skin sensitization. Acute exposure may cause eye, nose and throat irritation. Delayed reactions are common. Skin contact may cause inflammation. May cause occupational asthma.	E - Substitution with less harmful product. Local exhaust ventilation including spray booths. Enclosed processes. A - Safe work procedures including storage and disposal. Medical monitoring including pulmonary function testing. Good housekeeping. Good hygiene practices. Pre-placement awareness of sensitized individuals. WHMIS program and maintenance of MSDSs. Worker education. P - Chemical-protective clothing, gloves, eye and face protection, and respirators.	www.employment.alberta.ca/documents/WHS/WHS-PUB_choo5.pdf www.cdc.gov/niosh/npg/npgd0356.html

Other chemicals and substances continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Latex	Used in gloves, medical devices, some respirators, elastic bands, balloons, etc.	Exposure can produce irritant contact dermatitis, allergic contact dermatitis, and allergic responses including immediate hypersensitivity and shock.	E - Substitution with less harmful product. Properly designed and maintained ventilation systems. A - Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present. As per hazard assessment.	www.ohsah.bc.ca/media/46-HB-LatexinHealthcare.pdf www.ccohs.ca/oshanswers/diseases/latex.html?print
Lead	May be present in some paints, lead shielding for diagnostic imaging areas, batteries, pesticides, solder, and ceramics/ stained glass shops in residences, plumbing connections.	Most exposures are by inhalation of dust and fumes and possible accidental ingestion if hands are contaminated. Effects may impact nervous system and reproductive system. May also affect digestive tract and anaemia.	E - Substitution with less harmful products. Local exhaust and dust collection systems. Enclosed processes. A - Regular medical monitoring of affected workers if there is the potential for overexposure. Exposure monitoring. Safe work procedures. Education of workers in the nature of the hazard. Good housekeeping. Good hygiene practices. Equipment maintenance programs. P - Protective clothing, gloves, eye and face protection, and respirators based on hazard assessment.	www.employment.alberta.ca/documents/WHS/WHS-PUB_cho61.pdf www.cdc.gov/niosh/npg/npgd0368.html

Other chemicals and substances continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Mercury	Metallic mercury may be found in thermometers, pressure gauges (manometers), other medical devices and dental fillings, etc.	Exposure is through inhalation of vapours, ingestion and skin absorption. Skin sensitizer. Corrosive as liquid. Target effects to the nervous system, kidneys, cardiovascular and eyes.	E - Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Properly designed and maintained ventilation systems. Local exhaust ventilation may be required. A - Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of the work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure. P - Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.	www.employment.alberta.ca/documents/WH5/WH5-PUB_choo3.pdf www.cdc.gov/niosh/npg/npgdo383.html www.mtpinnacle.com/pdfs/MERCURY-USE-%20HOSPITALS-AND-CLINICS.pdf
Methyl methacrylate	Surgical and dental prosthesis.	Eye, skin and mucous membrane irritant. Central nervous system and cardiac effects. Skin sensitizer.	E - Substitution with less harmful product. Properly designed and maintained ventilation systems. Enclosed mixing devices. Local exhaust ventilation. A - Safe work procedures. Good hygiene practices. Education of workers in the nature of the hazard. WHMIS program and maintenance of MSDSs. Medical monitoring of workers. P - Gloves, eye protection and face shields. Respirators based on hazard assessment.	www.cdc.gov/niosh/npg/npgdo426.html www.cdc.gov/niosh/hcwold5b.html

Other chemicals and substances continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Personal care products, scents and fragrances	A wide range of products including personal care items such as shampoos, soaps, perfumes, creams, deodorants, etc. Also contained in cleaning products.	May cause a variety of mild to severe symptoms. Allergic, asthmatic and sensitive workers may experience reactions.	E - Elimination of scented products. Substitution with less harmful products. Properly designed and maintained ventilation systems. A - Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker education.	www.ccohs.ca/oshanswers/hsprogram/scent_free.html
Pesticides/ rodenticides/ insecticides	Pest and rodent control in facilities and residences.	Exposure may occur by inhalation, skin contact and accidental ingestion.	E - Substitution with less harmful product. Adequate ventilation. A - Safe work procedures. Application of products when the fewest workers may be present. Use of qualified and licensed contractors to apply products. Education of workers in the nature of the hazard. Good housekeeping. Good hygiene practices. P - Protective clothing, gloves, eye and face protection, and respirators based on hazard assessment.	www.ccohs.ca/oshanswers/chemicals/pesticides/general.html www.hse.gov.uk/pubns/biopestindex.htm www.osha.gov/SLTC/healthguidelines/warfarin/recognition.html www.employment.alberta.ca/documents/WHS/WHS-PUB_cho56.pdf

Other chemicals and substances continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
Second-hand tobacco smoke	May be present in public places where smoking is permitted. Also may be encountered in homes or establishments where home care workers or public health workers provide services.	Lung cancer and other cancers. Associated with heart disease, respiratory irritation, aggravation of allergies and other pre-existing conditions. Impacts developing foetus.	E - Elimination of smoking within and around facilities. Properly designed and maintained ventilation systems. Isolation of areas where smoking is permitted with dedicated ventilation systems. Substitution with smoking cessation aids. A - Development, implementation and enforcement of no smoking policies and policies related to worker exposure in homes. Substitution with smoking cessation aids. Smoking cessation programs. Collection of patient smoking information on patient intake forms in home or community settings. Worker education. Good housekeeping. Provision of services in an alternate location if client is uncooperative with no smoking policies.	www.healthlink.mcw.edu/article/1031002601.html www.ccohs.ca/oshanswers/psychosocial/ets_health.html
Vehicle exhaust (e.g., Carbon monoxide)	Present in garages, vehicle maintenance areas, ambulance bays, loading docks, emergency generators, helipads, in areas where (internal combustion) forklifts are used etc. Carbon monoxide is present in vehicle exhaust and concentrations may vary considerably based on the machinery, maintenance and other factors. Other contaminants present will include particulates, nitrogen and sulphur compounds.	A variety of components of exhaust produce acute and chronic effects, including irritation of respiratory tract, eye, nose and throat, neurological impacts, and may be carcinogenic; exposure may occur through ventilation system if air intakes are located near loading docks or locations in proximity to vehicle traffic.	E - Substitution with less harmful products or equipment, battery/ electrical powered equipment. Properly designed and maintained ventilation systems. Local exhaust ventilation. Isolation of workers. Installation of emission control devices and alarm systems. Facility design to control exhaust build up and migration especially in proximity to facility air intakes. <i>Continued on page 106.</i>	www.osha.gov/SLTC/dieselexhaust/recognition.html www.erd.dli.mt.gov/safetyhealth/brochures/dieselexhaust.pdf www.employment.alberta.ca/documents/WH5/WH5-PUB_ch031.pdf

Other chemicals and substances continued

Chemical (category or group)	Common Uses and Examples	Exposure and Health Effects Information	Controls	For more information:
These are examples of chemicals, uses, health effects and controls. For each chemical used in the workplace, specific information MUST be consulted to determine controls based on what the product is used for, how it is used and the environment it is used in. This may be found on MSDSs, information provided by the manufacturer or supplier, or other sources. Individual reactions to chemicals must also be considered in determining appropriate controls.				
			Continued from page 105. A - Development and enforcement of policies and procedures that require vehicle engines to be shut off in loading areas and in proximity to facility air intakes. Vehicle maintenance to reduce emissions. Education of vehicle operators (workers, patients, clients' or residents' families, visitors' and suppliers) in the nature of the hazard for areas when entrainment of vehicle exhaust into a facility may be an issue. Monitoring systems for carbon monoxide and nitrogen oxides. P - PPE not typically required however, based on hazard assessment PPE may be required.	
Wood dust	May be present in wood-working shops in maintenance areas, prosthetics, residences and long term care facilities.	Exposure may occur to workers in areas where wood-work is conducted, including construction areas. Hazards depend on the types of wood and may include a wide range of toxic effects. Some types of wood are carcinogens. May cause dermatitis, asthma, sensitization, respiratory effects and hypersensitivity reactions.	E - Substitution with less harmful woods or other products. Local exhaust ventilation on wood-working equipment. A - Education of workers in the nature of the hazard. Safe work procedures. Purchasing controls to include choosing alternatives. Good housekeeping including wetting procedures and dust suppression for dust clean up. Good hygiene practices. Equipment maintenance programs. P - Protective clothing, gloves, eye and face protection, and respirators based on hazard assessment.	www.employment.alberta.ca/documents/WH5/WH5-PUB_cho45.pdf www.cdc.gov/niosh/npg/npgdo667.html



Section 7 - Best Practices for the Control of Chemical Hazards, by Functional Areas²⁰

Chemical hazards have been identified in many areas of healthcare facilities and in many tasks performed by HCWs. Each organization must systematically conduct hazard assessments for tasks performed by HCWs. In this section the most commonly encountered chemical hazards and methods to control them in specific healthcare functional areas are presented. Employers should carefully evaluate the potential for exposure to chemical hazards in all areas and ensure that they have an effective hazard control plan in place. This information will be useful for inclusion into hazard assessments. Please note, this is not designed to be an exhaustive treatment of the subject, but is rather an overview summarizing the most frequently encountered chemical hazards in healthcare settings. When considering chemical hazards that workers may be exposed to, some workers who travel between sites, workplaces or work in community settings may be potentially exposed to a variety of chemicals that they themselves may not be working with, but are present in the areas in which they work. These chemical hazards must be included in the hazard assessment performed for these workers.

General Notes:

The following charts provide basic information about control strategies for commonly occurring chemical hazards. The selection of controls must be based on a risk assessment of the tasks and environment. Worker education and good communication processes are critical administrative controls. All legislation related to the assessment of hazards, selection and use of controls must be followed.

²⁰ Adapted from material covered in **Healthcare Hazard Control and Safety Management**, second edition, James T. Tweedy, CRC – Taylor & Francis, 2005, ISBN 1-57444-306-2

Direct Care - Medical Units

Potential Chemical Hazards	Examples of Controls		
	Engineering	Administrative	PPE
Exposure to a variety of cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase in ready to use concentrations to minimize handling. Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education.	Protective clothing, gloves and eye and face protection, and respiratory protection based on hazard assessment.
Exposure to disinfectants used for cleaning purposes.	Substitution with less harmful product. Properly designed and maintained ventilation systems. Automatic diluting machines.	Practice to purchase in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves and eye protection. Respirators based on hazard assessment.
Exposure to hazardous drugs through administration, clean-up or spill response procedures or through contact with contaminated bedding, body fluids and laundry.	Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices. Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items.	Safe work procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard, including pharmacists, shipping/receiving, nursing, housekeeping, laundry and facilities maintenance. Availability of appropriate equipment and PPE. Possible reassignment of workers who may be more susceptible to effects.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.

Direct Care - Medical Units Continued

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Properly designed and maintained ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	

Direct Care – Operating Rooms and Surgical Units

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves and eye protection. Respirators based on hazard assessment.
Exposure to ethylene oxide during off-gassing of sterilized items.	Substitution with less harmful product. Process design to adequately allow for ventilation of chambers. Local exhaust ventilation. Closed processes. Preventive maintenance on process equipment. Facility design. Leak alarms.	Safe work procedures including emergency release procedures. Provision of sufficient time for aeration. WHMIS program and maintenance of MSDSs. Worker education. Controlled access to work area and process equipment. Continuous air monitoring in work and equipment service areas. Routine exposure monitoring. Possible reassignment to accommodate sensitized workers.	Chemical-resistant gloves, protective clothing. Respiratory protection in accordance with hazard assessment.
Exposure to hydrogen peroxide used as a cold sterilant.	Substitution with less harmful product. Design and maintenance of ventilation systems. May require local exhaust ventilation. Enclosed processes.	Practice to purchase in ready to use concentrations to minimize handling. Safe work procedures. Safe storage. WHMIS program and maintenance of MSDSs. Worker education.	Gloves, eye and face protection and chemical-resistant protective clothing. Respiratory protection based on hazard assessment.
Exposure to anaesthetic gases through poor ventilation, leaks, or from off-gassing from patients.	Substitution with less harmful products. Design and maintenance of ventilation systems. Control of fugitive emissions with scavenging systems. Use of properly designed patient masks and induction systems to reduce emissions.	Safe work procedures. Preventative maintenance on equipment and systems. Routine occupational hygiene monitoring to evaluate worker exposure. Worker education.	

Direct Care – Operating Rooms and Surgical Units continued

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to hazardous drugs through administration, clean-up or spill response procedures or through contact with contaminated bedding, body fluids and laundry.	Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices. Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items.	Safe work procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard, including pharmacists, shipping/receiving, nursing, housekeeping, laundry and facilities maintenance. Availability of appropriate equipment and PPE. Possible reassignment of workers who may be more susceptible to effects.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.
Exposure to chemicals in laser plumes (biological agents may also be present and are discussed in Volume 2 of this series).	Well-designed smoke evacuation systems situated in close proximity to plume. Availability of smoke evacuation systems in all areas where plumes can be generated. Design and maintenance of ventilation systems.	Requirement to use smoke evacuation systems to be used whenever any sized plume is generated. Safe work procedures. Education of workers in the nature of the hazard. Preventative maintenance of systems. Adherence to CSA Standard Z305.13-09, <i>Plume Scavenging in Surgical, Diagnostic, Therapeutic and Aesthetic Settings</i> .	Gloves, eye, face and respiratory based on hazard assessment.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	

Direct Care – Operating Rooms and Surgical Units continued

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Contact with mercury through broken mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to methyl methacrylate used to secure prostheses to bone during orthopaedic surgery.	Substitution with less harmful product. Design and maintenance of ventilation systems. Enclosed mixing devices. Local exhaust ventilation.	Safe work procedures. Good hygiene practices. Education of workers in the nature of the hazard. WHMIS program and maintenance of MSDSs. Medical monitoring of workers.	Gloves, eye protection and face shields. Respirators based on hazard assessment.

Direct Care – Pre-hospital Emergency Responders

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to hazardous drugs through contact with contaminated bedding, body fluids and laundry.	Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices. Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items.	Safe work procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE. Possible reassignment of workers, especially pregnant workers.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.
Exposure to chemicals used in terrorist activities through contact with patients contaminated with chemical agents.	Design and maintenance of ventilation systems. Local exhaust ventilation. Isolation of areas where contamination may be present. Adequate decontamination facilities. Antidotes if available.	Develop and implement chemical, biological, radiological and nuclear response (CBRN) plan. Education of workers in the nature of the hazard and emergency procedures.	PPE as detailed in the CBRN plans.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	

Direct Care – Pre-hospital Emergency Responders continued

Potential Chemical Hazards	Examples of Controls		
	Engineering	Administrative	PPE
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to vehicle exhaust.	Substitution with less harmful products or equipment i.e. use propane rather than diesel, battery/electrical powered equipment. Design and maintenance of ventilation systems. Local exhaust ventilation where possible. Isolation of workers. Emission control devices. Facility design to control exhaust build up and migration, especially in proximity to facility air intakes.	Development and enforcement of policies and procedures that require vehicle engines to be shut off in loading areas and in proximity to facility air intakes. Vehicle maintenance to reduce emissions. Education of vehicle operators (workers, patients, clients' or residents' families, visitors and suppliers) in the nature of the hazard for areas when entrainment of vehicle exhaust into a facility may be an issue. Monitoring systems for carbon monoxide and nitrogen oxides.	PPE not typically required however, based on hazard assessment PPE may be required including respirators, protective clothing, gloves, eye and face protection.
Exposure to a variety of chemicals that may contaminate patients or their clothing or environment.	Controls should be chosen to protect workers based on the chemicals encountered, quantities, concentrations and required tasks. Design and maintenance of ventilation systems. Local exhaust ventilation. Isolation of areas where contamination may be present. Adequate decontamination facilities.	Safe work procedures. Education of workers in the nature of the hazard and work procedures. Triage procedures. Communication between first responders and site where patient was exposed.	PPE as required based on hazard assessment. Refer to individual MSDs and the links provided.

Direct Care – Emergency Rooms

Potential Chemical Hazards	Examples of Controls		
For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.			
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to hazardous drugs through contact with contaminated bedding, body fluids and laundry.	Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices. Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items.	Safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE. Possible reassignment to accommodate sensitized workers.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.
Exposure to chemicals used in terrorist activities through contact with patients contaminated with chemical agents.	Design and maintenance of ventilation systems. Local exhaust ventilation. Isolation of areas where contamination may be present. Adequate decontamination facilities. Antidotes if available.	Develop and implement chemical, biological, radiological and nuclear response (CBRN) plan. Education of workers in the nature of the hazard and emergency procedures.	PPE as detailed in the CBRN plans.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	

Direct Care – Emergency Rooms continued

Potential Chemical Hazards	Engineering	Administrative	PPE
Contact with mercury through broken mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to vehicle exhaust from ambulances.	Design and maintenance of ventilation systems. Local exhaust ventilation in ambulance bays where possible. Emission control devices. Facility design to control exhaust build up and migration especially in proximity to facility air intakes.	Development and enforcement of policies and procedures that require vehicle engines to be shut off in loading areas and in proximity to facility air intakes. Vehicle maintenance to reduce emissions. Education of vehicle operators (workers, patients, clients' or residents' families, visitors and suppliers) in the nature of the hazard for areas when entrainment of vehicle exhaust into a facility may be an issue. Monitoring systems for carbon monoxide and nitrogen oxides.	PPE not typically required however, based on hazard assessment PPE may be required including respirators, protective clothing, gloves, eye and face protection.
Exposure to a variety of chemicals that may contaminate patients or their clothing or environment.	Controls should be chosen to protect workers based on the chemicals encountered, quantities, concentrations and required tasks. Design and maintenance of ventilation systems. Local exhaust ventilation. Isolation of areas where contamination may be present. Adequate decontamination facilities.	Safe work procedures. Education of workers in the nature of the hazard and work procedures. Triage procedures. Communication between first responders and site where patient was exposed.	PPE as required based on hazard assessment. Refer to individual MSDSs and the links provided.

Direct Care – Long Term Care Patient Care

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to hazardous drugs through administration, clean-up or spill response procedures.	Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices. Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items.	Safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE. Possible reassignment to accommodate sensitized workers.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	
Contact with mercury through broken mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.

Direct Care – Long Term Care Patient Care continued

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to wood dust in woodworking activities.	Substitution with less harmful woods or other products. Local exhaust ventilation on wood-working equipment.	Education of workers in the nature of the hazard. Safe work procedures. Purchasing controls to include choosing alternatives. Good housekeeping including use of wetting procedures and dust suppression for dust clean up. Good hygiene practices. Equipment maintenance programs.	Protective clothing, gloves, eye and face protection, and respirators based on hazard assessment.
Exposure to substances used in craft activities and shops.	Substitution with less harmful product. Local exhaust and dust collection systems. Enclosed processes.	Safe work procedures. Education of workers in the nature of the hazard. Good housekeeping. Good hygiene practices. Equipment maintenance programs. Maintenance of MSDSs and compliance with all WHMIS requirements. Routine exposure monitoring.	Protective clothing, gloves, eye and face protection, and respirators based on hazard assessment.

Direct Care – Physical Therapy/Occupational Therapy/Respiratory Therapy/ Diagnostic Imaging/Recreation Therapy

Potential Chemical Hazards	Examples of Controls For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to glutaraldehyde or other cold sterilant for whirlpool tubs or for sterilizing equipment.	Substitution with less harmful product. Design and maintenance of ventilation systems. Local exhaust ventilation. Enclosed processes. Automation.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education. Routine exposure monitoring.	Chemical-resistant gloves, eye protection, face protection, and chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient.
Exposure to hazardous drugs through contact with contaminated clothing, bedding or other items, clean-up or spill response procedures.	Segregation of contaminated items.	Safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE. Possible reassignment to accommodate sensitized workers.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	

Direct Care – Physical Therapy/Occupational Therapy/Respiratory Therapy/ Diagnostic Imaging/Recreation Therapy continued

Potential Chemical Hazards	Examples of Controls		
	Engineering	Administrative	PPE
Exposure to lead from shielding materials.	Enclosed processes. Sealing of lead shielding materials.	Regular medical monitoring of affected workers if there is the potential for overexposure. Exposure monitoring. Safe work procedures. Education of workers in the nature of the hazard. Good housekeeping. Good hygiene practices. Equipment maintenance programs.	Protective clothing and gloves.
Contact with mercury through broken mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	

Direct Care – Physical Therapy/Occupational Therapy/Respiratory Therapy/ Diagnostic Imaging/Recreation Therapy continued

Potential Chemical Hazards	Examples of Controls		
For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.			
	Engineering	Administrative	PPE
Exposure to wood dust in woodworking activities.	Substitution with less harmful woods or other products. Local exhaust ventilation on wood-working equipment.	Education of workers in the nature of the hazard. Safe work procedures. Purchasing controls to include choosing alternatives. Good housekeeping including use of wetting procedures and dust suppression for dust clean up. Good hygiene practices. Equipment maintenance programs.	Protective clothing, gloves, eye and face protection, and respirators based on hazard assessment.
Exposure to substances used in craft activities and shops.	Substitution with less harmful products. Local exhaust and dust collection systems. Enclosed processes.	Regular medical monitoring of affected workers. Industrial hygiene monitoring of area. Safe work procedures. Education of workers in the nature of the hazard. Good housekeeping. Good hygiene practices. Equipment maintenance programs. Maintenance of MSDSs and compliance with all WHMIS requirements.	Protective clothing, gloves, eye and face protection, and respirators based on hazard assessment.
Exposure to film processing chemicals used in radiology.	General ventilation.	Safe work procedures on handling and disposal. Worker education.	Protective clothing, gloves.

Direct Care – Dialysis

Potential Chemical Hazards	Examples of Controls		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to glutaraldehyde or other cold sterilant when sterilizing equipment.	Substitution with less harmful product. Design and maintenance of ventilation systems. Local exhaust ventilation. Enclosed processes.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education. Routine exposure monitoring.	Chemical-resistant gloves, eye protection, face protection, and chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient.
Exposure to hazardous drugs through contact with contaminated bedding, body fluids and laundry.	Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices. Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items.	Safe work procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	

Direct Care – Dialysis continued

Potential Chemical Hazards	Examples of Controls For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Contact with mercury through broken mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to dialysis fluids and a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Local exhaust ventilation over sinks where chemicals are poured out. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.

Direct Care – Patient Transport continued

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to hazardous drugs through contact with patients or their clothing, equipment, etc.	Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items.	Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE. Possible reassignment to accommodate sensitized workers.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to vehicle exhaust.	Design and maintenance of ventilation systems. Local exhaust ventilation. Isolation of workers. Emission control devices. Facility design to control exhaust build up and migration especially in proximity to facility air intakes.	Development and enforcement of policies and procedures that require vehicle engines to be shut off in loading areas and in proximity to facility air intakes. Vehicle maintenance to reduce emissions. Education of vehicle operators (workers, patients, clients or residents families, visitors and suppliers) in the nature of the hazard for areas when entrainment of vehicle exhaust into a facility may be an issue. Monitoring systems for carbon monoxide and nitrogen oxides.	PPE not typically required however, based on hazard assessment PPE may be required including respirators, protective clothing, gloves, eye and face protection.

Direct Care – Dental Offices or Dental Clinics in Healthcare Facilities or Community Care Settings

Potential Chemical Hazards	Examples of Controls		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	
Exposure to mercury when handling mercury-containing amalgams.	Elimination of mercury containing amalgams. Substitution with less harmful product. Design and maintenance of ventilation systems. Local exhaust ventilation when removing old amalgams.	Safe work procedures. Education of workers in the nature of the hazard. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to methyl methacrylate used as a filler.	Substitution with less harmful product. Design and maintenance of ventilation systems. Enclosed mixing devices. Local exhaust ventilation.	Safe work procedures. Good hygiene practices. Education of workers in the nature of the hazard. WHMIS program and maintenance of MSDSs. Medical monitoring of workers.	Gloves, eye protection and face shields. Respirators based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	

Direct Care – Community Clinics/ Doctors' Offices

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	
Exposure to hazardous drugs through administration, clean-up or spill response procedures.	Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices. Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items.	Safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE. Possible reassignment to accommodate sensitized workers.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.

Direct Care – Community Clinics/ Doctors' Offices continued

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Contact with mercury through broken mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	

Direct Care – Home Care and Community Care Providers

Potential Chemical Hazards	Examples of Controls For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to hazardous drugs through administration, clean-up or spill response procedures or through contact with contaminated bedding, body fluids and laundry.	Proper containment when making up or transporting drugs. Engineered needle stick prevention devices. Segregation of contaminated items.	Safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment (including a home care spill kit) and PPE.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirator based on hazard assessment.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	
Contact with mercury through broken mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.

Direct Care – Home Care and Community Care Providers continued

Potential Chemical Hazards	Examples of Controls For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to second-hand smoke in clients' homes.	Eliminate smoking. Substitution with smoking cessation aids. Design and maintenance of ventilation systems. Isolation of areas where smoking is permitted.	Develop, implement and enforce no smoking policies and policies related to worker exposure in homes (e.g. no smoking within 30 minutes prior to visit). Support smoking cessation programs. Gather patient smoking information on patient intake forms in home or community settings. Worker education. Good housekeeping. Provision of services in an alternate location if client is uncooperative with no smoking policies.	
Exposure to chemicals that may be present in clients' home.	Controls should be chosen to protect workers based on the chemicals encountered, quantities, concentrations and required tasks. Elimination. Substitution with less harmful product. Design and maintenance of ventilation systems.	Safe work procedures and worker education. Avoidance of areas where chemicals are being stored or used, if possible.	PPE as required based on hazard assessment. Refer to individual MSDSs and the links provided.

Direct Care – Mental Health Workers

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Contact with mercury through broken mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to second-hand smoke in clients' homes.	Eliminate smoking. Substitution with smoking cessation aids. Design and maintenance of ventilation systems. Isolation of areas where smoking is permitted.	Develop, implement and enforce no smoking policies and policies related to worker exposure in homes (e.g. no smoking within 30 minutes prior to visit). Support smoking cessation programs. Gather patient smoking information on patient intake forms in home or community settings. Worker education. Good housekeeping. Provision of services in an alternate location if client is uncooperative with no smoking policies.	

Direct Care – Public Health Officers

Potential Chemical Hazards

Examples of Controls

For each chemical used in the workplace, the appropriate specific information **MUST** be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.

	Engineering	Administrative	PPE
Exposure to chemicals used in terrorist activities through contact with patients, clients or work environments contaminated with chemical agents.	Design and maintenance of ventilation systems. Local exhaust ventilation. Isolation of areas where contamination may be present. Adequate decontamination facilities. Antidotes if available.	Development and implementation of a chemical, biological, radiological and nuclear response (CBRN) plan. Education of workers in the nature of the hazard and emergency procedures.	PPE as detailed in the CBRN plans.
Exposure to chemicals used in illegal activities (e.g. grow ops, clandestine labs, etc.)	Isolation of abatement areas. Contract out abatement activities to qualified contractors.	Education of workers in the nature of the hazard. Safe work procedures. Coordination of response procedures with first responders and law enforcement.	PPE as required based on hazard assessment which may include protective clothing, gloves, eye and face protection and respirators. High level PPE may be required including full containment suit and self contained breathing apparatus.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to second-hand smoke in client homes or work environments being inspected.	Eliminate smoking. Substitution with smoking cessation aids. Design and maintenance of ventilation systems. Isolation of areas where smoking is permitted.	Development, implementation and enforcement of no smoking policies and policies related to worker exposure in homes. Support for smoking cessation programs. Collection of patient smoking information on patient intake forms in home or community settings. Worker education. Good housekeeping. Provision of services in an alternate location if client is uncooperative with no smoking policies.	

Direct Care – Public Health Officers continued

Potential Chemical Hazards	Examples of Controls		
	Engineering	Administrative	PPE
Exposure to a variety of chemicals that may contaminate clients or work environments.	Controls should be chosen to protect workers based on the chemicals encountered, quantities, concentrations and required tasks. Design and maintenance of ventilation systems. Local exhaust ventilation. Isolation of areas where contamination may be present. Adequate decontamination facilities.	Safe work procedures. Education of workers in the nature of the hazard and work procedures. Triage procedures. Communication between first responders and site where patient was exposed.	PPE as required based on hazard assessment. Refer to individual MSDSs and the links provided.
Exposure to chemicals present in client facilities.	Controls should be chosen to protect workers based on the chemicals encountered, quantities, concentrations and required tasks. Elimination. Substitution with less harmful product. Design and maintenance of ventilation systems.	Safe work procedures and worker education. Avoidance of areas where chemicals are being stored or used, if possible.	PPE as required based on hazard assessment. Refer to individual MSDSs and the links provided.

Support Services – Housekeeping

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to hazardous drugs through clean-up or spill response procedures.	Proper containment when making up drugs. Engineered needle stick prevention devices. Adequate ventilation in dedicated rooms when administering aerosolized drugs. Segregation of contaminated items.	Safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	
Contact with mercury through broken mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	

Support Services – Laundry

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to concentrated detergents and bleaches.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines. Closed systems.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to hazardous drugs in contaminated bedding and clothing.	Segregation of contaminated items.	Safe work procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE.	Protective clothing (gowns), eye protection and gloves. Respirators based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	

Support Services – Food Services

Potential Chemical Hazards	Examples of Controls For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to cleaning, disinfecting chemicals, including caustic drain, oven and grill cleaners.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to detergents and other cleaning agents.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.

Support Services – Security

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to chemicals used in terrorist activities through contact with patients contaminated with chemical agents.	Design and maintenance of ventilation systems. Local exhaust ventilation. Isolation of areas where contamination may be present. Adequate decontamination facilities. Provide antidotes if available.	Development and implementation of a chemical, biological, radiological and nuclear response (CBRN) plan. Education of workers in the nature of the hazard and emergency procedures.	PPE as detailed in the CBRN plans.
Exposure to latex from contact with latex gloves or components of medical devices.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to a variety of chemicals that may contaminate patients or their clothing.	Controls should be chosen to protect workers based on the chemicals encountered, quantities, concentrations and required tasks. Design and maintenance of ventilation systems. Local exhaust ventilation. Isolation of areas where contamination may be present. Adequate decontamination facilities.	Safe work procedures. Education of workers in the nature of the hazard and work procedures. Triage procedures. Communication between first responders and site where patient was exposed.	Refer to individual MSDSs and the links provided.

Support Services – Laboratory/Autopsy

Potential Chemical Hazards	Examples of Controls For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to formaldehyde when used as a tissue fixative in laboratories or in the morgue; Para formaldehyde is commonly used in the decontamination of biological safety cabinets for certification.	Substitution with less harmful product. Design and maintenance of ventilation systems. Local exhaust ventilation.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. Routine exposure monitoring. WHMIS program and maintenance of MSDSs. Worker education.	Chemical-resistant gloves, eye protection, face protection, and chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient.
Exposure to glutaraldehyde or other cold sterilants for disinfecting bench tops and biosafety cabinets or when used as a tissue fixative.	Substitution with less harmful product. Design and maintenance of ventilation systems. Local exhaust ventilation.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education. Routine exposure monitoring.	Chemical-resistant gloves, eye protection, face protection, and chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient.
Exposure to acids, bases, and other toxic chemicals used in diagnostic procedures.	Elimination where possible. Substitution with less harmful products. Design and maintenance of ventilation systems. Local exhaust ventilation may be required including fume hoods. Enclosed and automated processes.	Purchase products in small quantities with the highest dilution that is appropriate for the task. Safe work procedures including spill, proper waste handling and disposal procedures. Storage of products appropriately to decrease exposure or reactions. Maintenance of inventory of products and removal of unused or outdated products. WHMIS program and maintenance of MSDSs. Worker education.	Tight-fitting eye protection (indirect vented goggles), face shields, chemical resistant aprons, closed-toed shoes and appropriate gloves selected based on the nature of acid/base. Respirator based on hazard assessment.

Support Services – Laboratory/Autopsy continued

Potential Chemical Hazards	Examples of Controls For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a wide variety of solvents as reagents in diagnostic procedures.	Elimination of solvent use. Substitution of solvent with less harmful products. Design and maintenance of ventilation systems. Local exhaust ventilation may be required including fume hoods. Enclosed and automated processes. Grounded and bonded transfer equipment.	Purchase products with the highest dilution that is appropriate for the task. Safe work procedures including spill, proper waste handling and disposal procedures. Storage of products appropriately to decrease exposure or reactions. Maintenance of inventory of products and removal of unused or outdated products. Routine exposure monitoring. WHMIS program and maintenance of MSDSs. Worker education.	Gloves, eye protection and chemical-resistant protective clothing. Respiratory protection based on hazard assessment.
Exposure to latex from contact with latex gloves.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	
Exposure to mercury if there are broken thermometers or other mercury-containing equipment.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	

Support Services – Research Laboratories

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to formaldehyde when used as a tissue fixative in laboratories; Para formaldehyde is commonly used in the decontamination of biological safety cabinets for certification.	Substitution with less harmful product. Design and maintenance of ventilation systems. Local exhaust ventilation.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. Routine exposure monitoring. WHMIS program and maintenance of MSDSs. Worker education.	Chemical-resistant gloves, eye protection, face protection, and chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient.
Exposure to glutaraldehyde or other cold sterilants for disinfecting bench tops and biosafety cabinets or when used as a tissue fixative.	Substitution with less harmful product. Design and maintenance of ventilation systems. Local exhaust ventilation.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. Routine exposure monitoring. WHMIS program and maintenance of MSDSs. Worker education.	Chemical-resistant gloves, eye protection, face protection, and chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient.
Exposure to acids, bases, and other toxic chemicals used in research procedures.	Elimination where possible. Substitution with less harmful products. Design and maintenance of ventilation systems. Local exhaust ventilation may be required including fume hoods. Enclosed and automated processes.	Purchase products in small quantities with the highest dilution that is appropriate for the task. Safe work procedures including spill, proper waste handling and disposal procedures. Storage of products appropriately to decrease exposure or reactions. Maintenance of inventory of products and removal of unused or outdated products. WHMIS program and maintenance of MSDSs. Worker education.	Tight-fitting eye protection (indirect vented goggles), face shields, chemical resistant aprons, closed-toed shoes and appropriate gloves selected based on the nature of acid/base. Respirator based on hazard assessment.

Support Services – Research Laboratories continued

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a wide variety of solvents as reagents in research procedures.	Elimination of solvent use. Substitution of solvent with less harmful products. Design and maintenance of ventilation systems. Local exhaust ventilation may be required including fume hoods. Enclosed and automated processes. Grounded and bonded transfer equipment.	Purchase products with the highest dilution that is appropriate for the task. Safe work procedures including spill, proper waste handling and disposal procedures. Storage of products appropriately to decrease exposure or reactions. Maintenance of inventory of products and removal of unused or outdated products. Routine exposure monitoring. WHMIS program and maintenance of MSDSs. Worker education.	Gloves, eye protection and chemical-resistant protective clothing. Respiratory protection based on hazard assessment.
Exposure to mercury if there are broken thermometers or other mercury-containing equipment.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	

Support Services – Cast and Prosthetics Preparation and Seating Clinics

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to methyl methacrylate used in making casts.	Substitution with less harmful product. Design and maintenance of ventilation systems. Enclosed mixing devices. Local exhaust ventilation.	Safe work procedures. Good hygiene practices. Education of workers in the nature of the hazard. WHMIS program and maintenance of MSDSs. Medical monitoring of workers.	Gloves, eye protection and face shields. Respirators based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to toxic fumes during fabrication (may include styrene, vinyls, isocyanates, epoxides, etc.).	Substitution with less harmful product. Isolation where possible. Local exhaust ventilation. Enclosed and automated processes.	Safe work procedures including storage and disposal. Good hygiene practices. Education of workers in the nature of the hazard. Good housekeeping. Pre-placement awareness of sensitized individuals. Routine exposure monitoring. Medical monitoring of workers where warranted. WHMIS program and maintenance of MSDSs.	Gloves, eye protection and face shields. Respirators and protective clothing based on hazard assessment.
Exposure to nuisance dust.	Local exhaust ventilation; dust collection devices.	Good housekeeping including use of wetting procedures and dust suppression for dust clean up. Good hygiene practices. Equipment maintenance programs. Worker education.	Eye protection, Respirators based on hazard assessment.

Support Services – Central Processing

Potential Chemical Hazards	Engineering	Administrative	PPE
For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.			
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to ethylene oxide when removing items from the EtO sterilizer, moving items from the sterilizer to the aerator, and changing bottles of EtO gas.	Substitution with less harmful product. Ensure processes adequately allow for ventilation of chambers. Local exhaust ventilation. Use closed processes. Preventive maintenance on process equipment. Facility design. EtO sensors and alarms.	Safe work procedures including emergency release procedures. Provision of sufficient time for aeration. WHMIS program and maintenance of MSDSs. Worker education. Control access to work area and process equipment. Continuous air monitoring in work and equipment service areas. Routine exposure monitoring.	Chemical-resistant gloves, protective clothing (butyl apron), and appropriate air purifying respirator when changing cylinders.
Exposure to glutaraldehyde or other cold sterilants for disinfecting surgical instruments.	Substitution with less harmful product. Design and maintenance of ventilation systems. Local exhaust ventilation. Enclosed processes.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education. Routine exposure monitoring.	Chemical-resistant gloves, eye protection, face protection, and chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient.
Exposure to proteolytic enzymes.	Substitution with less harmful product or process. Enclosed processes.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education.	Gloves, face splash shields or procedure masks, moisture resistant gowns.
Exposure to latex from contact with latex gloves.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	

Support Services – Endoscopy

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities related to patient care.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to glutaraldehyde, ortho-phthalaldehyde, hydrogen peroxide, acetic acid, peracetic acid, proteolytic enzymes or other chemicals for disinfecting endoscopes.	Substitution with less harmful product. Design and maintenance of ventilation systems. Local exhaust ventilation. Enclosed processes. Automated washers-disinfectors.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures including spill procedures. WHMIS program and maintenance of MSDSs. Worker education. Routine exposure monitoring.	Chemical-resistant gloves, eye protection, face protection, and chemical-resistant protective clothing. Respirators for use in the event of spills. Respirators if engineering controls are insufficient.
Exposure to latex from contact with latex gloves or other medical equipment containing latex.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	

Support Services – Pharmacy

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to hazardous drugs through formulation procedures.	Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices.	Safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.
Exposure to hazardous drugs through clean-up or spill response procedures, receiving and unpacking, crushing and splitting, unit dose packaging.	Proper containment (isolation, segregated areas and dedicated equipment, local exhaust ventilation, biological safety cabinets, aerosol delivery tents and enclosures, etc.) when making up or using drugs. Engineered needle stick prevention devices.	Safe work procedures including spill procedures with consideration to the specific product and manufacturer's instructions. Waste handling procedures. Education of workers in the nature of the hazard. Availability of appropriate equipment and PPE.	Eye protection and face shields when splashing is possible. Protective clothing (gowns) and gloves. Respirators may be required based on hazard assessment.

Support Services – Biomedical Equipment Management

Potential Chemical Hazards	Examples of Controls		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Contact with mercury through servicing mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.

Support Services – Maintenance

Potential Chemical Hazards	Examples of Controls		
For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.			
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents in routine cleaning activities or in water treatment.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Worker education. Safe work procedures. WHMIS program and maintenance of MSDSs.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to battery components from spent batteries.	Design and maintenance of ventilation systems. Adequate ventilation in battery charging areas. Enclosed and automated processes.	Isolated and dedicated work area where batteries are handled. Safe work procedures including spill procedures. Worker education.	Tight fitting eye protection (indirect vented goggles), face shields, chemical resistant aprons, closed-toed shoes and appropriate gloves selected based on the nature of acid/base. Respirator based on hazard assessment.
Exposure to paints, coating and adhesives in building maintenance and upgrade activities, including exposure to solvents, isocyanates and various metals.	Substitution with less harmful products (water based products). Design and maintenance of ventilation systems. Local exhaust ventilation may be required including spray booths. Enclosed and automated processes.	Purchase of appropriate quantities of products. Safe work procedures including storage and disposal. Store products appropriately to decrease exposure and minimize fire hazards. Maintain inventory of products and remove unused products. Good hygiene practices. Good housekeeping. Schedule work to decrease workers' exposures. Medical monitoring of workers where warranted. WHMIS program and maintenance of MSDSs.	Gloves, eye protection and protective clothing. Respiratory protection may be required for some applications based on hazard assessment.
Exposure to asbestos by maintenance workers working in mechanical rooms and service areas where asbestos insulation is present, or making repairs to mechanical systems where asbestos insulation is present. There is also a potential of exposure to asbestos in older buildings where it may be a component of building materials, floor or ceiling tiles, fireproofing materials, wall board etc.	Isolation of abatement areas. Enclosed and contained asbestos-containing materials. Elimination of asbestos materials. Substitution with less harmful product.	Development of an asbestos management plan in compliance with legislative requirements. Identify asbestos containing materials. Safe work procedures including spill procedures. Education of workers in the nature of the hazard. Air sampling as required.	Select PPE as required by hazard assessment, may include full body protection, face/eye protection, and respiratory protection (including supplied air).

Support Services – Maintenance continued

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to latex from contact with latex gloves.	Substitution with less harmful product. Design and maintenance of ventilation systems.	Purchasing controls to limit latex containing materials from entering facility. Safe work procedures. Education of workers in the nature of the hazard, hand washing after glove removal, proper glove donning and removal. Work reassignment for workers with latex allergies to areas where latex is not present.	
Exposure to lead and other metals in shops and in walls in shielded areas.	Substitution with less harmful products. Local exhaust and dust collection systems. Enclosed processes.	Regular medical monitoring if there is the potential for overexposure. Perform exposure monitoring. Safe work procedures. Education of workers in the nature of the hazard. Good housekeeping. Good hygiene practices. Equipment maintenance programs.	Protective clothing, gloves, eye and face protection, and air-purifying respirators equipped with particulate filters based on hazard assessment.
Contact with mercury through broken mercury-containing devices.	Elimination of mercury containing equipment. Substitution with less harmful product. Enclosed mercury sources. Design and maintenance of ventilation systems.	Safe work procedures including spill procedures. Education of workers in the nature of the hazard and the potential to find mercury in vacuum lines and plumbing traps. Purchasing controls to restrict mercury containing materials from entering facility. Monitoring of work environment following a spill. Good hygiene practices. Appropriate storage of products to decrease exposure.	Protective clothing, gloves, eye and face protection, and respiratory protection based on hazard assessment.

Support Services – Maintenance continued

Potential Chemical Hazards	Examples of Controls		
	Engineering	Administrative	PPE
Exposure to pesticides and rodenticides used to reduce pest and rodent populations.	Substitution with less harmful product. Enclosed processes where possible. Design and maintenance of ventilation systems. Local exhaust ventilation where possible.	Safe work procedures. Application of products when the fewest workers may be present. Use of qualified contractors to apply products. Pest management program. Education of workers in the nature of the hazard. Good housekeeping. Good hygiene practices.	Protective clothing, gloves, eye and face protection, and respirators based on hazard assessment for specific product.
Exposure to wood dust in wood-working activities.	Substitution with less harmful woods or other products. Local exhaust ventilation on wood-working equipment.	Education of workers in the nature of the hazard. Safe work procedures. Purchasing controls to include choosing alternatives. Good housekeeping including use of wetting procedures and dust suppression for dust clean up. Good hygiene practices. Equipment maintenance programs.	Protective clothing, gloves, eye and face protection, and respirators based on hazard assessment.

Support Services – Drivers

Potential Chemical Hazards	Examples of Controls		
	Engineering	Administrative	PPE
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to vehicle exhaust.	Design and maintenance of ventilation systems. Local exhaust ventilation. Isolation of workers. Emission control devices. Facility design to control exhaust build up and migration especially in proximity to facility air intakes.	Development and enforcement of policies and procedures that require vehicle engines to be shut off in loading areas and in proximity to facility air intakes. Vehicle maintenance to reduce emissions. Education of vehicle operators (workers, patients, clients or residents families, visitors and suppliers) in the nature of the hazard for areas when entrainment of vehicle exhaust into a facility may be an issue. Monitoring systems for carbon monoxide and nitrogen oxides.	PPE not typically required however, based on hazard assessment PPE may be required including respirators, protective clothing, gloves, eye and face protection.

Support Services – Administration

Potential Chemical Hazards	Examples of Controls		
	For each chemical used in the workplace, the appropriate specific information MUST be consulted. The choice of controls must include consideration of what the product is used for, how it is used and the environment it is used in. Individual reactions to chemicals must also be considered in determining appropriate controls.		
	Engineering	Administrative	PPE
Exposure to a variety of disinfecting and cleaning agents.	Substitution with less harmful product. Design and maintenance of ventilation systems. Automatic diluting machines.	Practice to purchase products in ready to use concentrations to minimize handling. Safe work procedures. WHMIS program and maintenance of MSDSs. Worker education.	Gloves, eye and face protection. Respiratory protection based on hazard assessment.
Exposure to scented products that may induce sensitization.	Elimination of scented products. Substitution with less harmful products. Design and maintenance of ventilation systems.	Development, implementation and enforcement of scent-free policies. Signage in work areas where affected workers work. Worker and client education. Possible reassignment to accommodate sensitized workers.	
Exposure to laser printer emission, copier toners and other supplies, ozone generated by printers and copiers.	Design and maintenance of ventilation systems. Location of printers and copiers away from room occupants.	Purchasing procedures. Safe work procedures and education of workers in procedures. Proper storage of products. Limitation of number of printers/copiers in one room based on general ventilation rate.	Gloves based on hazard assessment.

Appendix 1

References used in preparing this document



Appendix 1 – References used in preparing this document

Books

Essentials of Modern Hospital Safety, Volume 3, William Charney, CRC Press, 1994, ISBN 1-56670-083-3

Guidelines for Laboratory Safety, Edition 6, 2006; Gene Marie Shematek, Wayne Wood; Canadian Society for Medical Laboratory Science. 0-921479-12-3

Healthcare Hazard Control and Safety Management, James T. Tweedy, CRC Press, 2005; ISBN 978-1-57444-306-6.

PPE Made Easy – A Comprehensive Checklist Approach to Selecting and Using Personal Protective Equipment. Jeffrey O. Stull; Government Institutes 1998.

The Work Environment, Volume 2- Healthcare, Laboratories and Biosafety; Doan Hansen, CRC Press, 1993, ISBN 0-87371-392-3

Toxicology Principles for the Industrial Hygienist, Luttrell, Jederberg, and Still, AIHA 2008. ISBN 978-1-931504-88-1

Regulatory and Standards Aspects

Alberta Building Code 2006 and Alberta Fire Code 2006 - www.municipalaffairs.alberta.ca/documents/ss/Code_info_sheet.pdf

Alberta Government Guideline for the Development of a Code of Practice for Respiratory Protective Equipment – PPE004 www.employment.alberta.ca/documents/WHS/WHS-PUB_ppe004.pdf

Alberta Government legislation related to chemicals in the workplace may be accessed through the Government website at www.employment.alberta.ca

Alberta Government, Workplace Health and Safety Bulletin “WHMIS – Information for Employers”, updated July 2009 and “WHMIS – Information for Workers” bulletins available at www.employment.alberta.ca

Alberta OHS Code 2009, Part 18 – Personal Protective Equipment

ANSI/ASHRAE 62.1 – 2007 User’s Manual; Ventilation for Acceptable Indoor Air Quality, available at www.techstreet.com/cgi-bin/detail?product_id=1571685

Code Explanation Guide for Part 4 (Chemical Hazards, Biological Hazards and Harmful Substances) found at http://www.employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_po4.pdf

CSA Z305.13-09 Plume scavenging in surgical, diagnostic, therapeutic, and aesthetic settings www.shopcsa.ca/onlinestore/GetCatalogItemDetails.asp?mat=2419604

Government of Alberta, Explanation Guide to *OHS Act*, Regulations and Code. 2009

Government of Alberta's IAQ Tool kit, available at www.employment.alberta.ca/documents/WHS/WHS-PUB_gho15.pdf

Respiratory Protective Equipment – An Employer's Guide; Workplace Health and Safety Bulletin; Alberta Government; revised July 2009. www.employment.alberta.ca/documents/WHS/WHS-PUB_ppe001.pdf

Workplace Health and Safety Bulletin – Handling and Storage of Flammable Materials at the Work Site accessible at www.employment.alberta.ca/documents/WHS/WHS-PUB_fex002.pdf
www.employment.alberta.ca/whs/learning/hazard/Hazard.htm

Industrial Hygiene

Canadian Registration Board of Occupational Hygienists, www.crboh.ca

National Institute for Occupational Safety and Health – US; browse by chemical www.cdc.gov/niosh/topics/chemical.html

OSH for Everyone, training manual, Chapter 8, Chemical Hazards, Ontario WSIB www.oshforeveryone.org/wsib/files/ont_wsib/certmanual/ch_o8.html

Controls

A Guide to Eyewash and Safety Shower Facilities, North Carolina Department of Labor, Division of Occupational Safety and Health, 2008. Available at www.nclabor.com/osha/etta/indguide/ig28.pdf

American Chemical Society – Chemical Storage resources membership.acs.org/c/ccs/safe_practices/storage_resources.htm

American Society of Hospital Pharmacists. ASHP technical assistance bulletin on handling cytotoxic and hazardous drugs. *Am J Hosp Pharm*. 1990; 47:1033-49.

Ansell Chemical Resistance Guide www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf

Best – Chemical Resistance Guide www.bestglove.com/site/chemrest/default.aspx

Canadian Centre for Occupational Health and Safety “OSH Answers – Substitution of Chemicals: Considerations for Selection” available at www.ccohs.ca/oshanswers/chemicals/substitution.html

CCOHS Publication OSH Answers – Industrial Ventilation; found at www.ccohs.ca/oshanswers/prevention/ventilation/

Contact Lenses at Work – CCOHS; www.ccohs.ca/oshanswers/prevention/contact_len.html

Controlling Chemical Exposures, Industrial Hygiene Fact Sheets; New Jersey Department of Health and Senior Services; www.nj.gov/health/surv/documents/ihfs.pdf

Cornell University – Safe Chemical Use www.ehs.cornell.edu/lrs/manual/ch7.cfm#7.9.1

Glove Use in Laboratories; University of Florida Chemical Hygiene Plan; www.ehs.ufl.edu/Lab/CHP/gloves.htm

Kimberly Clark Product Selector Tool www.kcprofessional.com/us/mkt/pselectortool/Disclaimer.aspx

Laboratory Safety Supply – Chemical Compatibility Concerns in Storage www.labsafety.com/refinfo/ezfacts/ezf181.htm

McGill University – Laboratory Safety Manual www.mcgill.ca/ehs/laboratory/labsafety/#cli_4

Medical College of Georgia – Chemical Storage Plan for laboratories www.mcg.edu/services/ehs/chemsafe/chemstor.htm

Microflex Chemical Resistance Guide www.microflex.com/Products/~media/Files/Literature/Microflex%20Chemical%20Resistance%20Guide.ashx

NIOSH – Medical Surveillance for Health Care Workers Exposed to Hazardous Drugs. Available at www.cdc.gov/niosh/docs/wp-solutions/2007-117/

North Chemical Resistance Guide (for gloves) www.ehs.ufl.edu/Lab/CHP/North.pdf

OSH Answers – Safety Glasses and Face Protectors;
www.ccohs.ca/oshanswers/prevention/ppe/glasses.html

OSH Answers- Chemical Protective Clothing – Gloves;
www.ccohs.ca/oshanswers/prevention/ppe/gloves.html

Recommendations for Chemical Protective Clothing: A Companion
to the NIOSH Pocket Guide to Chemical Hazards: Database;
www.cdc.gov/niosh/ncpc/ncpci.html

Science Lab – Chemical Storage Recommendations [www.sciencelab.com/
page/S/CTGY/22005](http://www.sciencelab.com/page/S/CTGY/22005)

Sustainable Hospitals - [www.sustainablehospitals.org/cgi-bin/
DB_Index.cgi](http://www.sustainablehospitals.org/cgi-bin/DB_Index.cgi)

University of the State of New York, Chemical Storage Guidelines
www.emsc.nysed.gov/ciai/mst/pub/chemstorguid.html

University of Vermont – Proper Storage of Chemicals
www.uvm.edu/~esf/chemicalsafety/chemicalstorage.html

WHMIS Core Material: A resource manual for the application and
implementation of WHMIS; WorkSafeBC; [www.worksafebc.com/
publications/health_and_safety/whmis/assets/pdf/whmis_core_full.pdf](http://www.worksafebc.com/publications/health_and_safety/whmis/assets/pdf/whmis_core_full.pdf)

WHMIS program information, the Canadian Centre for Occupational
Health and Safety (CCOHS) [www.ccohs.ca/oshanswers/legisl/intro_
whmis.html](http://www.ccohs.ca/oshanswers/legisl/intro_whmis.html).

Chemicals used for cleaning and disinfection

ANSI/AAMI ST58-96 Safe Use and Handling of Glutaraldehyde-Based
Products in Health Care Facilities www.cdc.gov/niosh/docs/2001-115/

BC Centre for Disease Control – A Guide for the Selection
and Use of Disinfectants [www.mtpinnacle.com/pdfs/
disinfectant-selection-guidelines.pdf](http://www.mtpinnacle.com/pdfs/disinfectant-selection-guidelines.pdf)

CCOHS – Corrosive Materials and their Hazards
www.ccohs.ca/oshanswers/chemicals/corrosive/corrosiv.html

CCOHS – Health Effects of Formaldehyde Solutions [www.ccohs.ca/
oshanswers/chemicals/chem_profiles/formaldehyde/health_for.html?print](http://www.ccohs.ca/oshanswers/chemicals/chem_profiles/formaldehyde/health_for.html?print)

CCOHS – How do I Work Safely with Corrosive Liquids and Solids?

www.ccohs.ca/oshanswers/prevention/corrosiv.html

CCOHS – Personal Protective Equipment Information for Formaldehyde

Solutions www.ccohs.ca/oshanswers/chemicals/chem_profiles/formaldehyde/personal_for.html

CDC – Ethylene Oxide Sterilizers in Healthcare Facilities – Engineering

Controls and Work practices www.cdc.gov/niosh/89115_52.html

City of Ottawa – Frequently Asked Questions about Alcohol-Based hand

Sanitizers www.ottawa.ca/residents/health/emergencies/pandemic/hand/faq_gel_en.html

CSA Z314.0-01 Installation, Ventilation, and Safe Use of Ethylene Oxide Sterilizers in Health Care Facilities.

Government of Alberta Municipal Affairs – Fire Code and Hand Hygiene

in Health Care Facilities www.municipalaffairs.alberta.ca/documents/ss/STANDATA/fire/fcb/97fcb026.pdf

Healthcare Environmental Resource Centre – Cleaning Chemicals

www.hercenter.org/hazmat/cleaningchems.cfm

Johns Hopkins Safety Manual – Guidance for Employees Using OPA

to Disinfect Equipment www.mtpinnacle.com/pdfs/Cydex.pdf

Johnson & Johnson – MSDS – Cidex OPA Solution www.sterrad.com/Customer_Support/user_resources/msds/cidexopa_msds.pdf

New Jersey Department of Health and Seniors Services – Glutaraldehyde –

Guidelines for Safe Use and Handling in Health Care Facilities

www.nj.gov/health/surv/documents/glutar.pdf

NIOSH – browse OHS subjects by chemical www.cdc.gov/niosh/topics/chemical.html

NIOSH – Occupational Hazards of Glutaraldehyde in Hospitals

www.cdc.gov/niosh/docs/2001-115/

NIOSH – Reducing Pesticide Exposure at Schools

www.cdc.gov/niosh/docs/2007-150/

NIOSH Pocket Guide to Chemical Hazards – Hydrogen Peroxide

www.cdc.gov/niosh/npg/npgd0335.html

NIOSH Safety & Health Topic- Ethylene Oxide www.cdc.gov/niosh/topics/ethyleneoxide/

OSHA – Hospital eTool – Glutaraldehyde www.osha.gov/SLTC/etools/hospital/hazards/glutaraldehyde/glut.html

OSHA – occupational health and safety topics – Formaldehyde www.osha.gov/SLTC/formaldehyde/index.html

OSHA eTool – Exposure to Ethylene Oxide Gas www.osha.gov/SLTC/etools/hospital/central/central.html#ExposuretoEthyleneOxideGas

OSHA Standards- Ethylene Oxide www.osha.gov/SLTC/ethyleneoxide/standards.html

Practice Green Health – Sterilants and Disinfectants in Healthcare Facilities cms.h2e-online.org/ee/hazmat/hazmatconcern/steril/

University of Medina and Reggio Emilio – Detergents www.museo.unimo.it/ov/fdrEdete.htm

University of Virginia, Biosafety program, Comparison of Disinfectants https://vprgsecure.web.virginia.edu/bio/disinfectant_summary.html

US – OSHA – Best Practices for the Safe Use of Glutaraldehyde in Health Care www.osha.gov/Publications/3258-o8N-2006-English.html

Chemicals used in diagnostic tests

Berkeley Lab – Chemical Hygiene and Safety Plan – Control Procedures for Acids and Bases www.lbl.gov/ehs/chsp/html/acids_bases.shtml

Brigham Young University – Acid Safety www.ee.byu.edu/cleanroom/acid_safety.phtml

Brigham Young University – Solvent Safety www.ee.byu.edu/cleanroom/solvent_safety.phtml

CCOHS – Flammable and Combustible Liquids Hazards - www.ccohs.ca/oshanswers/chemicals/flammable/flam.html

CCOHS – How do I Work Safely with Flammable and Combustible Liquids? www.ccohs.ca/oshanswers/prevention/flammable_general.html

NIOSH Pocket Guide to Chemical Hazards – Isopropyl Alcohol www.cdc.gov/NIOSH/NPG/npgd0359.html

Chemicals used in treatment

ASHP Guidelines on Handling Hazardous Drugs www.ashp.org/DocLibrary/BestPractices/ASHPGuidelinesHandlingHazardousDrugs.aspx

CCOHS – Hazards of Waste Anaesthetic Gases www.ccohs.ca/oshanswers/chemicals/waste_anesthetic.html

Duke University – Safe Handling of Hazardous Drugs
www.mtpinnacle.com/pdfs/safe-handling-hazardous-drugs.pdf

IRSTT – Prevention Guide – Safe Handling of Hazardous Drugs
www.irstt.qc.ca/en/_publicationirstt_100390.html

NIOSH – Hazardous Drug Exposures in Health Care www.cdc.gov/niosh/topics/hazdrug/

NIOSH – Occupational Exposure to Antineoplastic Agents
www.cdc.gov/niosh/topics/antineoplastic/

NIOSH – Preventing Occupational Exposure to Antineoplastic and Other Hazardous Drugs in Health Care Settings www.cdc.gov/niosh/docs/2004-165/2004-165b.html#j

OSHA – Potential Health Hazards Associated with the process of Compounding Medications from Pharmaceutical grade Ingredients
www.osha.gov/dts/tib/tib_data/tib20011221.html

OSHA Technical Manual – Controlling Occupational exposure to hazardous Drugs www.osha.gov/dts/osta/otm/otm_vi/otm_vi_2.html

Chemicals used in maintenance activities

Alberta Government – Workplace Health and Safety Bulletin – Spray Application of Paint and Coatings www.employment.alberta.ca/documents/WHS/WHS-PUB_ch004.pdf

Brigham Young University – Solvent Safety www.ee.byu.edu/cleanroom/solvent_safety.phtml

CCOHS – Corrosive Materials and their Hazards www.ccohs.ca/oshanswers/chemicals/corrosive/corrosiv.html

CCOHS – Flammable and Combustible Liquids Hazards -
www.ccohs.ca/oshanswers/chemicals/flammable/flam.html

CCOHS – How do I Work Safely with Corrosive Liquids and Solids?
www.ccohs.ca/oshanswers/prevention/corrosii.html

CCOHS – How do I Work Safely with Flammable and Combustible Liquids?
www.ccohs.ca/oshanswers/prevention/flammable_general.html

Education Safety Association of Ontario – Your Workplace is Being Painted
www.esao.on.ca/downloads/pamphlet_pdfs/workplace_painting.pdf

Electronic Library of Construction OHS – Adhesives and Glues
www.elcosh.org/docs/hazard/chemical_adhesives.html

Health and Safety Executive – Leaflets – Biocides and Pesticides
www.hse.gov.uk/pubns/biopestindex.htm

NIOSH – Reducing Pesticide Exposure at Schools
www.cdc.gov/niosh/docs/2007-150/

NIOSH Pocket Guide to Chemical Hazards – Sulfuric Acid
www.cdc.gov/niosh/npg/npgd0577.html

Woodworking Hazards www.angelfire.com/nc/conally/hazard.html

Chemical waste materials

CCOHS – Hazards of Waste Anaesthetic Gases
www.ccohs.ca/oshanswers/chemicals/waste_anesthetic.html

OSHA Hospital eTool – Surgical Suite – Smoke Plume www.osha.gov/SLTC/etools/hospital/surgical/surgical.html#LaserPlume

NIOSH – Control of Smoke from Laser/ Electric Surgical Procedures
www.cdc.gov/niosh/hc11.html

Other chemicals

Alberta Government – Workplace Health and Safety Bulletin – Isocyanates at the Work Site www.employment.alberta.ca/documents/WHS/WHS-PUB_choo5.pdf

Alberta Government – Workplace Health and Safety Bulletin – Lead at the Work Site www.employment.alberta.ca/documents/WHS/WHS-PUB_cho61.pdf

Alberta Government – Workplace Health and Safety Bulletin – Asbestos at the Work Site www.employment.alberta.ca/documents/WHS/WHS-PUB_cho19.pdf

Alberta Government – Workplace Health and Safety Bulletin –
Mercury at the Work Site [www.employment.alberta.ca/
documents/WHS/WHS-PUB_chc03.pdf](http://www.employment.alberta.ca/documents/WHS/WHS-PUB_chc03.pdf)

Biological and Chemical Terrorism Defense – A View from the Front Lines
of “Public Health”; Fred Henretig, MD; American Journal of Public Health,
May 2001 www.ajph.org/cgi/reprint/91/5/718.pdf

CCOHS – Compressed Gases Hazards [www.ccohs.ca/oshanswers/
chemicals/compressed/compress.html](http://www.ccohs.ca/oshanswers/chemicals/compressed/compress.html)

CCOHS – Environmental Tobacco Smoke – General information and
Health Effects www.ccohs.ca/oshanswers/psychosocial/ets_health.html

CCOHS – Health Effects from Exposure to Wood Dust [www.employment.
alberta.ca/documents/WHS/WHS-PUB_chc045.pdf](http://www.employment.alberta.ca/documents/WHS/WHS-PUB_chc045.pdf)

CCOHS – How do I Work Safely with Compressed Gases?
www.ccohs.ca/oshanswers/prevention/comp_gas.html

CCOHS – Latex Allergy [www.ccohs.ca/oshanswers/diseases/
latex.html#print](http://www.ccohs.ca/oshanswers/diseases/latex.html#print)

CCOHS – Pesticides – General www.hse.gov.uk/pubns/biopestindex.htm

CCOHS – Scent-Free Policy for the Workplace [www.ccohs.ca/oshanswers/
hsprograms/scent_free.html](http://www.ccohs.ca/oshanswers/hsprograms/scent_free.html)

Chemical Hazards Related to Clandestine Drug Laboratories (article)
www.health.state.mn.us/divs/eh/meth/lab/jhughart.pdf

Montana Department of Labor and Industry – Diesel Exhaust Health
Hazards www.erd.dli.mt.gov/safetyhealth/brochures/dieselexhaust.pdf

National Academies and US Department of Homeland Security – Chemical
Attack – Warfare Agents, Industrial Chemicals and Toxins [www.nae.edu/
NAE/pubundcom.nsf/weblinks/CGOZ-66JRHZ/\\$file/chemical%20
attack%2006.pdf](http://www.nae.edu/NAE/pubundcom.nsf/weblinks/CGOZ-66JRHZ/$file/chemical%20attack%2006.pdf)

NIOSH – Browse OSH Topics by Chemical [www.cdc.gov/niosh/topics/
chemical.html](http://www.cdc.gov/niosh/topics/chemical.html)

NIOSH Pocket Guide to Chemical Hazards – Asbestos
www.cdc.gov/niosh/npg/npgd0041.html

NIOSH Pocket Guide to Chemical Hazards – Isophorone Diisocyanate
www.cdc.gov/niosh/npg/npgdo356.html

NIOSH Pocket Guide to Chemical Hazards – Lead www.cdc.gov/niosh/npg/npgdo368.html

NIOSH Pocket Guide to Chemical Hazards – Mercury Compounds
www.cdc.gov/niosh/npg/npgdo383.html

NIOSH Pocket Guide to Chemical Hazards – Methyl Methacrylate
www.cdc.gov/niosh/npg/npgdo426.html

NIOSH Pocket Guide to Chemical Hazards – Wood Dust
www.cdc.gov/niosh/npg/npgdo667.html

OH&S Magazine – Coping with Meth Lab Hazards www.ohsonline.com/Articles/2006/11/Coping-with-Meth-Lab-Hazards.aspx

OHSAH – Latex in Healthcare www.ohsah.bc.ca/media/46-HB-LatexinHealthcare.pdf

OSHA – OSH Guidelines for Warfarin www.osha.gov/SLTC/healthguidelines/warfarin/recognition.html

OSHA Hazards and Solutions- Diesel Exhaust www.osha.gov/SLTC/dieselexhaust/recognition.html

UBC Chemistry – Compressed Gases Safe Handling Information
www.chem.ubc.ca/safety/safety_manual/hazard_chem_gases.shtml

Wisconsin Mercury Sourcebook – Mercury Use – Hospitals and Clinics
www.mtpinnacle.com/pdfs/MERCURY-USE-%20HOSPITALS-AND-CLINICS.pdf

www.ccohs.ca/oshanswers/chemicals/pesticides/general.html

Appendix 2

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Glossary of Terms
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Appendix 2 – Glossary of Terms²¹

Antineoplastic drug: Drug used in the treatment of cancer by interfering with mitotic cell division or protein synthesis (affecting normal cells also).

Area monitoring: Evaluation of the level of contamination or exposure to a chemical contaminant in an area; frequently used for evaluating contamination; often used to estimate human exposure potential for workers in an area.

Biological monitoring: Evaluation of chemical components or metabolic by-products through the testing of biological samples, e.g. blood, urine, hair, etc. to determine worker exposure.

Carcinogen: Agent identified as causing cancer (a disease characterized by uncontrolled abnormal proliferation of cells).

Chemical hazard: A chemical that, because of its characteristics and effects, may cause harm to an individual.

Chemical irritant: Chemical causing an immediate reaction when the worker is exposed to it. It may affect the part of the body in contact with the chemical (skin, respiratory tract, etc.) or produce a more systemic response due to absorption of the chemical.

Cytotoxic: Toxic action directed at cells rather than the tissue or the organism.

Electrocautery: A surgical technique that removes unwanted tissue, seals blood vessels and creates incisions through the application of high frequency electric current.

Genotoxic: Toxic action that causes alteration or damage to genetic material (DNA or chromosomes).

Industrial Hygiene: The science of identifying, evaluating and controlling workplace exposures to hazardous agents.

Laser plume/Surgical smoke: By-product of the use of lasers and electrocautery devices for surgical procedures; may contain a variety of chemical and biological hazards.

Local exhaust ventilation: Ventilation provided near the source of the hazard, designed to draw the chemical away from the worker before it can reach the worker's breathing zone e.g. chemical fume hoods, smoke evacuators, etc.

²¹ Many of these definitions have been extracted from *Toxicology Principles for the Industrial Hygienist*, Luttrell, Jederberg, and Stli, AIHA 2008. ISBN 978-1-931504-88-1

Mutagen: Agent causing a temporary or permanent change in a gene or chromosome or altering the chromosome number.

Neurotoxin: Agent identified as causing effects to the nervous system including brain function.

OEL: Occupational Exposure Limit – the airborne concentration of a substance that cannot be exceeded.

Personal monitoring: Evaluation of individual exposure through collection of exposure data near the route of entry for the individual worker.

Sensitization: An allergic response after repeated exposure to a substance.

Substitution: The process of choosing a less harmful chemical to replace a chemical with hazardous properties.

Target organ: The organ(s) in the body where a particular chemical agent exerts its toxic effects.

Teratogen: A substance that causes developmental defects or death in a foetus.

Toxicokinetics: The term used to describe the movement of toxins through the body.

WHMIS: Workplace Hazardous Materials Information System – the Canadian system to address safety of controlled products by requiring Material Safety Data Sheets, labels and worker training.

Appendix 3

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Chemical Safety Checklist (Example)
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Appendix 3 – Chemical Safety Checklist (Example)

General Chemical Safety

- ☐ Chemicals properly labelled?
- ☐ Chemicals properly stored?
- ☐ MSDSs readily accessible?
- ☐ Staff aware of location of MSDSs?
- ☐ MSDSs current?
- ☐ Chemical response procedures available?
- ☐ Staff trained on chemical response for chemical in their areas?
- ☐ Flammable liquids stored in approved containers and cabinets?
- ☐ Flammable liquids stored in approved quantities?
- ☐ Chemical storage shelves are appropriate?
- ☐ WHMIS policy in place?
- ☐ Chemical inventories available for all areas?
- ☐ Chemical inventories current?
- ☐ Workplace labels available where required?
- ☐ Purchasing procedures require hazard assessment for new chemicals?
- ☐ Workers have received initial WHMIS orientation?
- ☐ Workers receive periodic WHMIS updates?
- ☐ Contractors required to identify chemicals in use on site?
- ☐ Hazard assessments include identification of chemical hazards?
- ☐ Controls identified and chosen according to hierarchy of controls?
- ☐ Ventilation systems maintained?
- ☐ Local exhaust ventilation systems verified at least annually?
- ☐ Eye protection required where chemicals are used?
- ☐ Protective clothing required where deemed necessary?
- ☐ Is there a respiratory Code of Practice?

- ☐ Adequate numbers, types, sizes of PPE available?
- ☐ Respirator fit-testing in place?
- ☐ Safe work procedures documented, followed, and enforced?
- ☐ Decontamination of surfaces and equipment done as required?
- ☐ Appropriate eye wash facilities available?
- ☐ Appropriate shower facilities available?
- ☐ Are spill kits available and adequate?
- ☐ Routine maintenance and checks done on emergency eyewash and shower equipment?
- ☐ Proper number and types of fire extinguishers available?

Surgical department/Operating theatres

- ☐ Volume of used anaesthetic gases recorded and reviewed to identify leakages?
- ☐ Scavenging system checked regularly for leaks?
- ☐ Adequate general ventilation provided?
- ☐ Flammable anaesthetics stored in separate locations and vented to the outside?
- ☐ Periodic monitoring of worker exposures to anaesthetic gas completed?
- ☐ Compressed gas cylinders properly handled, used, stored and transported?
- ☐ Anaesthesia machines checked before use?
- ☐ Oxygen and nitrous oxide tanks secured?
- ☐ Piped gas connections checked?

Food Services

- ☐ Hoods, exhaust fans, filters and vent ducts cleaned regularly?
- ☐ Workers trained in the use of fire suppression systems?
- ☐ Automatic fire extinguishers (range-hood) inspected as required?
- ☐ Chemicals not stored near food items?

Laboratories

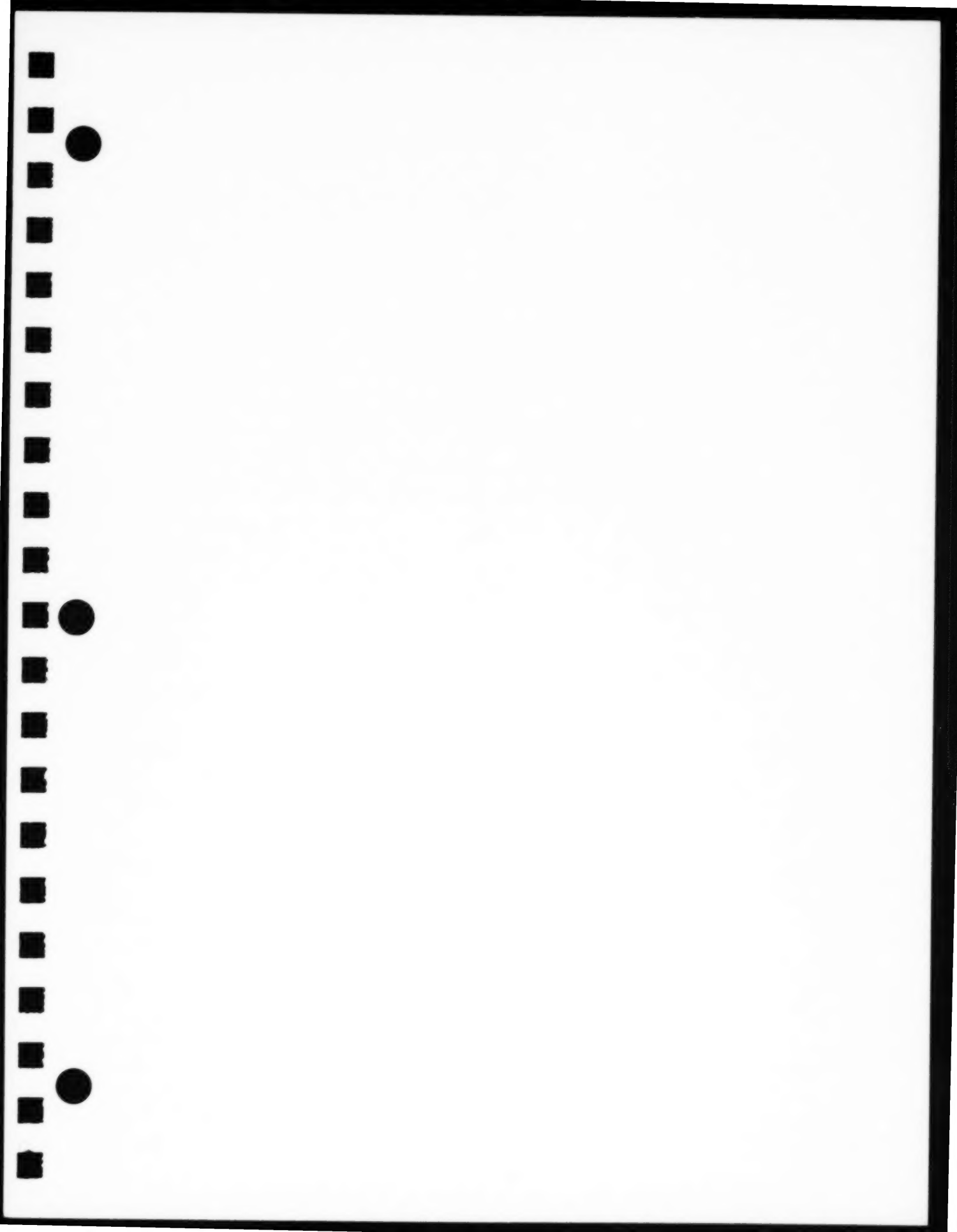
- ☐ Chemicals stored properly?
- ☐ Chemical spill kits available?
- ☐ Chemical spill kits checked regularly?
- ☐ Periodic worker exposure monitoring done as required for toxic substances?
- ☐ Fume hoods maintained and certified properly?
- ☐ Fume hoods free of chemicals and other items?
- ☐ Fume hoods ducted to outside?
- ☐ Are emergency eye washes/showers available and tested regularly?
- ☐ Workers wear proper PPE?
- ☐ Workers wear closed shoes?
- ☐ Compressed gas cylinders properly handled, used, stored and transported?
- ☐ Trash cans fire-rated?

Pharmacy

- ☐ Kept locked when not occupied?
- ☐ List of cytotoxic/hazardous drugs posted?
- ☐ Chemicals stored properly?
- ☐ Chemical spill kits available?
- ☐ Chemical spill kits checked regularly?
- ☐ Are eye washes available and flushed regularly?
- ☐ Safety cabinets maintained and certified annually?
- ☐ Use of needles reduced as much as possible?

Maintenance areas

- ☐ Hazardous chemicals properly stored and labelled?
- ☐ PPE available and required?
- ☐ Confined space program in place?
- ☐ Inventory of asbestos completed?
- ☐ Safe work procedures developed, implemented and enforced?
- ☐ Elimination or substitution with less harmful products where possible?
- ☐ Work scheduling done to reduce exposure?
- ☐ Local exhaust ventilation available where required?
- ☐ Workers trained and qualified for hazardous work?
- ☐ Vehicles not left running?
- ☐ Chemical spill response equipment available?
- ☐ Emergency eye wash and shower equipment available and maintained?



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